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Incentives for Indirect Labor

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INCENTIVES FOR INDIRECT LABOR

by

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LIFE

Gerald Curtis Stone was born in Chicago, Illinois, January 21, 1931.

He was graduated from Hyde Park High School in Chicago, Illinois, June, 1948, and from the University of Illinois, Urbana, Illinois, February 1953, with the degree of Bachelor of Arts.

From 1953, until the present, excluding a two year term in the army, the author has worked in various capacities of Industrial Engineering ranging from time study to industrial trouble-shooting, the capacity in which the author is now engaged.

This latter position has brought the author in an advisory capacity, into all functions of an industrial organization from front door Sales, Fabrication, and Customer Service, through Product Development, Purchasing, Accounting, Material Handling and Traffic. The basic "why" of the Industrial Engineer has served as the guiding light to serve management in obtaining maximum smoothness and efficiency of operation at a minimum cost.

From December, 1953 until December, 1955, the author was in the United States Army as a High Speed Radio Operator. He began his graduate studies at Loyola University in September, 1956.

PREFACE

This thesis has been prepared in recognition of the increasing attention given to the installation of incentives for indirect labor. In past years, the great bulk of labor was that on the production line, namely, direct labor. Output was low and methods were slow, resulting in relatively low indirect labor requirements to provide service to the manufacturing group.

Now, with expanding indirect functions in relation to the direct functions and a high degree of control of the direct production areas, management is turning its attention to the indirect groups, who hithertofore, were controlled merely by using whatever quantities of people were required to get the job done.

This thesis recognizes many of the ways that management is now controlling the required quantities of indirect labor through the use of incentives.

Very special thanks are due those individuals and companies who provided detailed insight into their handling of incentives for indirect labor. Their request for anonimity will be honored throughout this thesis.

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CHAPTER I

INTRODUCTION

The purpose of this paper is to tell what has been done and is now being done in the field of indirect incentives, what types of occupations may be covered with incentives, and the yardsticks used to measure production for the various occupations constituting the groups called indirect labor.[1] Many articles have been written and talks given, telling of various indirect groups that have been covered with incentives. For some of the categories to be covered, the measurements and applications from one group to another are similar. Similar incentives may be applied in other industries with little deviation. However, for other types of indirect labor groups, the measurements used for incentives will be greatly varied from one group to the next. Although several different types of measurements will be reflected in the chapters to follow, they may reflect little more than sample possibilities to anyone intending to apply standards to an indirect labor group.

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1. Indirect labor may be defined as those individuals or groups who do not by their own physical efforts affect the quality or form of the product, but do perform work in connection with the product. Careful avoidance of the term "indirect incentives" has been exercised. An indirect incentive is one which measures the worker with a factor over which he has virtually no control. Incentives for indirect labor may be either indirect incentives or direct incentives. Direct incentives are established on a basis of a given quantity of work that is recognized as assignable directly to a group or individual.

since the nature of organizations may vary so greatly.

Occupations Included. The breakdown of the occupations included is a categorizing which reflects industry in general. No industry will have all of the groups included, and certainly, the measurements would not be applicable to similar occupations in other lications. Most industries will have several of the occupations presented. Some industries having the same occupations, may categorize them as direct labor, such as a mail order house, where order fillers pick orders ready for shipment, this being the beginning and end product, rather than a step of the production process. Although, this type of activity is considered as a business, rather than an industry. many of the occupations which occur in it, would appear in industries.

Office businesses, such as insurance companies or banks present another type of labor which "do not by their own efforts affect the quality or form of" a product. These groups in factories would perform clerical or non-supervisory staff functions and will represent the first group to be included in this paper. Since the product generally handled by this group is paperwork, the method of establishing indirect incentives will in many situations be applicable to the strictly paperwork generating enterprises. This category will include such groups as Industrial Engineering. Industrial Relations people, Accounting people, Engineers, Draftsmen, Production Control people, Secretaries, Typists, and Clerks. Their supervisors will also be included. Great care has been taken in giving examples of the occupations

in this group to include only "front office" type occupations. Clerical functions, such as Timekeepers, Mill Clerks and Recorders of various types will be considered in a more appropriate category of "indirect jobs in the factory." Further analyses and breakdowns of these groups, and even sub-catagories, where differences will affect the measurements will be expressed in Chapter II dealing with these general categories.

The following chapter will deal with indirect jobs in the factory.. namely those jobs in the previous paragraph when performed in direct conjunction with the factory and at the site of manufacture. Also included in this chapter will be those factory "unmeasurable jobs,"[2] so called, because of the general unrepetitiveness of the work. One such group is maintenance, others are packing, shipping, receiving, inspection, testing and trouble-shooting, and special construction crews. Material handlers, set-up men, stock room people and others may be less repetitive based on the degree of individuality of the product as may occur in a job shop operation.

The last group to be discussed is that of management, namely, the measurement of the supervisors of all of the aforementioned categories in addition to the company's executives and Foremen of the direct labor crews.

Advantages of Incentives for Indirect Labor. Some of the

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2. Virgil Rotroff, "Now Those Unmeasurable Jobs are Measurable," Factory, CXVII (February, 1959), 192-193.

advantages of incentives for indirect labor become increasingly apparent from reading a list which one company's Industrial Engineering Department recently included in a carefully formulated program to sell management on the virtues of installing an incentive in a particular area. This area was the first area in indirect incentives in that particular company, in that the only other types of measurements previously used were of the indirect type.

Advantages of Indirect Wage Incentives

1. To achieve maximum interest in individual workers, in order to secure contributions to better department use of labor, work area and material, and thereby improve the division's cost performance.

2. To provide a more scientific approach in controlling indirect labor costs than the mere acceptance of a "favorable trend."

3. Such a "yardstick" will relieve upper management of the burden of closely scrutinizing the amount of labor in these groups.

4. It will provide appreciable savings by maintaining the hours of indirect work at a minimum.

5. Area management will be relieved of the burden of explaining "too many people" or pleading for additional people believed to be required in the division.

6. They provide an impetus to management to reduce lag-time in reducing indirect labor in proper relationship to direct labor.

7. To enable maximum productive performance of the direct operations.

At this time, this particular indirect labor problem will cease to exist as a problem. The sole judgement easily made of utilization of these indirect labor

groups will be "area management is doing its job" or is not doing its job".[3]

The advantages listed, present many obvious implications. In the first advantage listed, of achieving "maximum interest in individual workers", the basic self preservation that most rational humans posess is reflected. It simply points out that the employees will receive added compensation for added work and will be recognized for both poor and acceptable quantities of work. The standard, in whatever form it exists, although it may in many cases not be pointed toward any one individual, will indicate the company's expectations by recognizing the hundred per cent performance mark.

Item two refers to the fact that a pre-formulated method of calculating standard performance, is far better than the company's executives being satisfied with a lower ratio of indirect to direct labor than has existed previously or making abstract judgements that quantities of indirect labor may seem too great.

The third statement indicates the difficulties implied in the second statement, that upper management has to guess and judge on the basis of limited facts, what quantities of indirect labor are required. In this statement is indicated that management may look merely at a performance, with perhaps a few simple implications, to determine that indirect labor in a given area is, or is not doing its job. This would be far simpler than the

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3. The company whose document was the source of this quote wished to remain anonymous.

intensive inquisitions required without such measures.

The fifth item is an answer to the third whereby lower management does not have to satisfy the whims of upper management in its allowable and acceptable quantities of personnel. Area supervision with the aid of incentives for its indirect people may judge objectively if the people in the area are not working hard enough, or perhaps, if additional personnel are needed. When the standard indicates that considerably more people would be warranted by the number of standard hours, bonus or other measure used, the supervisor may simply increase his force. This is possible, of course, assuming that poor performance by the objective measure does not come as a result of the force increase.

The sixth advantage reflects deeply seated implications. Previously, before the installation of indirect incentives, in the area included in the report, management could not tell what effect the increase or decrease of labor had on the immediate future of the area. As a result of the indirect incentive and careful study by the Industrial Engineers, the requirements, as a result of the affect of changes in the related direct labor force were made evident. Thus, indirect supervisors could follow the formula objectively instead of waiting to see what would happen.

The maintaining of "indirect work hours at a minimum" is self evident in its purpose as the basic reason for any type of incentive installation--to use less man hours to do the job.

The last item "to enable maximum productive performance of the direct operation" suits the definition previously given of work

performed "in conjunction with the product." In the paper quoted for discussion are included material handling and set-up occupations, which by their nature are those which keep the lines rolling. If these occupations are not providing the material to be worked on and also clearing the assembly line for continued production,, the direct crews performance would surely suffer. Even more indirectly, the same may be said for amintenance men, who keep the machines running and the factory in good mechanical condition, Industrial Engineers, who provide the best working methods, the janitors, who provide the surroundings for a better working atmosphere, etc.

In another report, many of the ideas of the above are reiterated as reasons why there should be incentives:

> As an aid in meeting our high performance standards, we have stressed the systematic use of facts to sharpen managerial and supervisory judgement. As a specific example, we have concentrated on the use of timestudy and other forms of work measurement to improve performance through increasing efficiency.
>
> Our work in this field is aimed at providing management and supervision with performance yardsticks and other aids which they can use to improve their operations. Partly as a result of our efforts in this area, we have attained a favorable competitive position in the industry while at the same time providing thousands of jobs at good wages and outstanding fringe benefits for our people.
>
> Now however, the profits of our Company and the jobs of our people are being threatened by ever-increasing competition . . .[4]

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4. The Management Consultant firm whose work on a Supervisory Manual is shown here wishes to remain anonymous.

In still another manual for a different group by the same consultant firm it is stated that the indirect incentives were "initiated primarily to supply departments with a means of evaluating performance from the standpoint of utilization of manpower and accomplishment of work assignments. The program will also assist in the control of clerical costs, the determination of personnel requirements and in other related areas."[5]

Still another report states that their "manager's purpose is to plan clerical costs more adequately and to compel performance to conform to plan more precisely."[6] This item reflects similar thinking to that implied in items two, four, and five of the first set of advantages listed.

The foregoing advantages are aimed at the lower echelon people. In another analysis aimed at management incentives, added advantages as well as overlapping can easily be seen.

> An effective supervisory incentive program controls manufacturing costs--cuts them and holds them down and at an expense that's less than the savings.
>
> It provides a parellel means of maintaining a proper differential between the earnings of supervisors and supervised. That applies especially where there is an incentive for the workers.
>
> A supervisory incentive helps draw the lower echelon of supervision closer to the core of management. It gives them some financial stake in successful operations.

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5. Ibid., Procedure Manual.

6. Billy E. Goetz, "Planning and Controlling Routine Clerical Costs," Advanced Management, XXIII (October 1958), 23.

> It provides a means of comparing performances of individual supervisors for development and promotion programs.
>
> It helps integrate the contribution to operations by service and staff departments (if they are included in the plan).[7]

Another periodical article in the same series as that above, suggest the same advantages as the first four just mentioned, plus the added advantages:

> It's as much of an incentive during periods of slack and low production as when things are humming. That's important, we think, because we are just as anxious (if not more so) to inspire efficiency when we're staring a loss in to face as we are during lush periods.[8]

The last series of advantages is highlighted by answering the question, "Why do we have this plan? Because management was convinced that the line supervisors could cut and control costs--if stimulated by proper incentive."[9]

Primarily, periodical literature has been used in this study. Since the field is fairly new, not texts have been written as yet. Various companies have provided the author with their processes and formulae used in the development of their incentive applications.

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7. Robert S. Rice, "Incentives for Supervisors," Factory, CXI (July 1953), 97.

8. J. E. Heidgen and Hiley Davis, "Incentives for Middle Management," Factory, CXI (July 1953), 98.

9. George E. McCarthy and John J. Plocar, "Control Costs with Supervisor's Incentives," Factory, CXI (July 1953), 103.

CHAPTER II

INCENTIVES FOR CLERICAL AND NON-SUPERVISORY STAFF GROUPS

Levels Included. This chapter is concerned with incentives for clerical and non-supervisory staff groups. It may be said that this group is the furthest, most in direct group in relation to the direct production.. Indirect labor in the factory works adjacent to and in direct connection with the direct factory people. The management group is composed of the direct labor workers' supervisors and their associates. The clerical group, as included here consists of the non-supervisory, front-office workers. Table I, following, covers the incentive installations to be discussed in the chapter.

TABLE I

INCENTIVE PLANS DISCUSSED IN THIS CHAPTER

Plan No.	Occupations Covered (Company)	Page References
1.	Miscellaneous Clerical (Pitney Bowes)	11, 13, 15, 18 19, 21, 25.
2.	All Office and Clerical (Anonymous Consultant Developed Plan)	16, 25.
3.	Supervisors, Lower Management and Clerical (American Seating)	12, 14, 18, 24, 26, 29, 75, 79, 88.
4.	Clerical Operations (Micro Switch)	15, 16.

Since this group consists in large part of women office workers, the motivation to perform at a higher than average rate is by and large less than that of the factory or management groups. This is true because the women workers are neither supporting families, as a general rule, or seeking to advance in the business world as are the factory workers and members of management respectively.

Gilbert Brooks, Chief Time Study Engineer of the Pitney Bowes Company recognizes the sensitivity of women office workers in his statement which follows: "The technical problems of clerical work measurement can be solved by any good industrial engineer trained in the field of shop incentive principles, however, it requires an exceptionally good industrial engineer with plenty of tact, and diplomacy to take on the job of conditioning the office employees to time measurements."[1]

The job of selling incentives to workers is the most difficult in this area, not only because of the sensitivity mentioned above, of women office workers, but because of professional pride in the male workers. Also, the tradition of no time clock and the salary basis of pay, weighs heavily against receiving a favorable welcome in the installation of office incentives. Factory workers may not resist incentives, on an individual basis, besides the fact that incentives are more or less, traditionally acceptable in the

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1. Gilbert Brooks, "Measuring Office Operations for Incentive" Unpublished works from an address to the Eighth Annual Systems Meeting, Detroit, Michigan. (October 1955), 2.

factory.

Recognizing the always wise approach of letting the people know what you have in mind when changes are to be made, Mr. Brooks and his Industrial Engineers carefully explained his objectives to the first pilot group in his clerical incentive installation (Plan No. 1). This was done by ". . . holding a series of meetings with the supervisors and the employees. At these meetings we explained the function of time study, showed how time studies were taken, how we plotted our elemental time, values in order to arrive at the standard times and showed them sample time studies. After these meetings we made a point of sitting down with each operator and again explaining our function, . . . "[2]

The above approach was a direct one from and company's Industrial Engineering group to their fellow employees in another department. Another organization handled the installation of clerical and office incentives (Plan No. 2) through the use of a management consultant firm specializing in this type of endeavor. In this latter company, the management consultant team prepared a lesson plan format to their employees. In this more impersonal approach was included an explanation of the company's competitive situation and the increasing needs of controlling and reducing operating costs. Workers were told how the plan was to work and how measurements were to be set up. An appeal was made that both the company and the employees would benefit. Selected pertinent

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2. Ibid., p. 4.

questions were asked and answered to stimulate further questions that the groups may have.[3]

It was interesting to note in the Pitney Bowes Company's installation (Plan No. L) that after careful indoctrination in the pilot group, additional groups actually requested incentive coverage, at a snowballing pace, until maximum coverage was achieved. People found that they could increase their earnings, without a loss of dignity. This, of course, does not mean that every employee chose to work harder to make more money. Some preferred to work at a lesser pace for their base rate.[4] Instances were found where a special need arose, and such individuals would work to attain the incentive pace and then settle back to the base rate. Attempts were made, of course, to place those workers who wanted to be on incentive in the covered areas, and other workers in areas which were not going to be covered for some time, if at all.[5]

The Pitney Bowes incentive covered just under thirty per cent of all office employees at their home office and factory, representing a general cross section of all their office functions to include order and traffic people, all typing work, order-form group filing, duplicating, accounting sections of various types, record

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3. Anonymous Procedures Manual.

4. Base rate. The pay expressed in dollars per time period to which other considerations in wages are added, such as incentive premium, overtime, shift bonus. The hourly rate of pay on which incentive earnings are based. Generally a guarantee.

5. Ibid. p. 9.

sections, advertising and tabulating.

The consultant-developed incentive plan covers every worker in the organization who is not on a direct production status. The pecularities of studying the groups will be included elsewhere in this chapter under the section on methods of measurement and yardsticks of production.

Other groups included more specifically, in addition to the strictly clerical function are those of Industrial Engineers, Methods Engineers, Plant Engineers, and the like in for example, the American Seating Company of Grand Rapids, Michigan, incentive plan (Plan No. 3). This plan is based on budget performance, and is paid to Supervisors, lower management, and clerical people on the basis of their control over production and operating costs.[6]

Yardsticks of Production. One of the most difficult problems in establishing indirect incentives is that of determining the measurement of the crews efforts. How many more units of production are being produced, than were produced previously? In the factory, for direct labor, this is easy. One merely counts the pieces that are produced or examines equipment production charts or cycle counts. The people delegated to write incentives for indirect occupations have the imagination to select that factor which most closely reflects the effort of the incentive individual or group. In this section will be found a variety of measurements or yardsticks, ranging from piece work measurements to

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6. Heidgen, p. 98.

abstract budget performance figures. Although an informal analysis must be made of several yardsticks in the form of taking various measurements, studies or looks at historical records, a yardstick must finally be selected before intensive work can be begun in the measurement of the crew for incentive standards.

The Pitney Bowes Company plan (Plan No. 1) measures performance through the yardstick of number of copies made in the reproducing section, quantity of letters typed of a given size type, and other units of production which may be construed as little more than piecework type incentives paying the base rate for performance under one hundred percent. This incentive is on an individual basis in some departments and a group basis in others, the reason for the variation being the nature of work in some areas causing otherwise unmeasurable jobs or lack of differentiation where one worker begins and another left off.[7] The Micro Switch Company (Plan No. 4) uses a similar piecework measure in its clerical operations, developing flow charts to show the times for each phases of an operation.

Methods of Measurement or Developing Standards. Whatever yardstick is selected to be the basis of establishing an incentive , some sort of standard must be applied to the actual production to determine if it is better than what is expected or worse. The development of standards may take a multitude of forms

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7. Brooks, p. 12.

based on the type of yardstick that is used.

The previously mentioned Micro Switch Company (Plan No. 4) chose the use of Work-Factor Predetermined Time Values as applied to previously methodized operations. This involved a two step approach:

1. To get standard working conditions.
2. Break down analytically the conditions and standardize them.[8]

The use of this type of measure means an element by element observance of a task. Ultimately standard data can be used which picks up broader categories encompassing many elements. This company as a Work-Factor user in its direct operations had the facilities and trained personnel to perform the Work-Factor analyses required to set up the measurement by this method.

The management consultant (Plan No. 2) laid out a plan incorporating several work study techniques, all different from the above, although "predetermined time values, which are generally based on measurements of body movements will be used to compare results obtained under the above three methods".[9]

1. Timestudy is the measurement of the actual performance of a task by a stopwatch. Depending on the circumstances, tasks will generally be broken down into elements and stopwatch readings for each element will be recorded.

   The number of cycles studied will depend on the com-

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8. Robert L. Humphrey, "System Standards and System Analysis," An unpublished address to the Work-Factor Associates of the Midwest, Chicago, Illinois (October 1959).

9. Anonymous Procedures Manual.

plexity of the task. A convenient rule of thumb suggests taking studies of 50 cycles or one half hour, whichever is shorter.[10]

Insofar as practical, time observations will be made by continuous reading methods[11] although sometimes observations, such as measurement of isolated elements will be made using snapback[12] method.

2. Work Sampling is a technique for determining the time spent in performing various tasks by random sampling. Based on the law of probability, a sufficient number of samples of an activity will provide the ratios to the total time devoted to the activity for a given period will indicate the time spent in each task. The comparison of production with time for each task as developed by Work Sampling, will indicate per unit time.

3. Average actual is a method for establishing unit times through the averaging of actual production for a given period of time. In most cases, average actual will be determined by a simple arithmetic average. However, abnormal times will be excluded from the averaging.[13]

Any of the above methods yield a figure based on actual or levelled time.[14] These figures must be converted by use of such allowances as personal, fatigue, delay and incentive opportunity.

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10. Ibid.

11. Continuous reading method is a time study method in which the timepiece runs continuously. Readings are taken at breaking points and the observed elemental times are obtained by subtraction.

12. Snap back method is where the watch is returned to zero at the beginning of each element, reading the observed time at the end of the element.

13. Anonymous Procedures Manual.

14. Levelled time is determined by comparing an operator's performance or effective effort with the observer's own concept of proper performance as compared to a bench mark.

The consultant's procedure shows the charts used in calculating and converting to develop standard time values, but he has requested that they not be included in this study. Basically, they are similar to any standard time study or work sampling averaging sheet.

The American Seating Company plan (Plan No. 3) uses still another type of standard, namely that of a historical record, revised by a predetermined method to cover normal changes in operating budgets which are the standards, applying the appropriate required quantities, for a given cost based on the level of operating activity. Only those ". . . costs that are clearly beyond the control of the participant--raw material price fluctuations, taxes of all kinds, insurance, etc." are excluded as standards.[15]

Through time study, predetermined time values and average typing speeds Pitney Bowes (Plan No. 1) developed rates for various clerical functions. A sample of the composition of a typical typing standard is shown in Table II from the text of Mr. Brooks' lecture.

In analyzing this standard data, one may observe that all of the elements of typing a letter from a dictaphone. Many of the elements would be similar in all dictaphone rates, requiring only a change of the variable elements such as number of lines, number of copies, etc. Elements such as number seventeen--allowance for

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15. Heidgen, p. 101.

TABLE II

DEVELOPMENT OF A TYPICAL TRANSCRIBING RATE

Premise: A standard type letter is dictated by B. J. Hotair, Vice-President in charge of Vice-Presidents. The letter consists of ten lines of type in the body and requires five carbon copies. The letter is typed by a girl in Transcribing using an electric typewriter with elite type.

Let's see how this rate would be set--

		/Std. Min/
1.	Check correspondence on job to be typed.	.143
2.	Turn and open desk drawers.	.026
3.	Pick out paper for work to be typed--(6 copies).	.286
4.	Interleave carbons (5 carbons).	.455
5.	Position paper in machine, straighten and position to type.	.182
6.	Position dictaphone plugs in ears.	.065
7.	Type data and space.	.078
8.	Type inside address and space.	.286
9.	Type salutation and space.	.065
10.	Type 10 lines of 5⅛" length--Standard letter (.195 X 10).	1.950
11.	Type signature, section, initials, c.c., etc.	.299
12.	Type dictation date.	.046
13.	Remove ear plugs and aside.	.065
14.	Remove typing from machine.	.033
15.	Remove carbons and aside.	.052
16.	Attach letters to correspondence with clip and aside.	.143
17.	Allowance for erasing one error and correcting (1 every 10 lines) (6 copies).	.832
18.	Change dictaphone roll (.0223 per line X 10 lines).	.223

5.229 @ 24% -- 1.255

\+ 5.229

6.484 -- Allowed Time /in min./

erasing, were of course, based on averages of several studies. The 24% applied at the end of the above calculation is for personal, fatigue and delay allowances.

TABLE III

STANDARD ALLOWED TIMES

TRANSCRIBING DEPARTMENT

Time Allowed in Minutes--Elite Type--Electric Machine

No. of lines In Body 4½"	5½"	6½"	Simplified	Standard	Inter Office	No. of lines In Body 4½"	5½"	6½"	Branch Memo	No. of Lines	Techn'l. Line of Type
1	1	1	3.21	3.39	3.58	1-2	1	1	3.63	1	.64
2-3	2	2	3.71	3.89	4.08	3	2	2	4.17	2	1.28
4	3	-	4.21	4.39	4.58	4-5	3-4	3	4.70	3	1.91
5	4	3	4.71	4.89	5.08	6	5	4	5.23	4	2.55
6	5	4	5.21	5.39	5.58	7	6	5	5.77	5	3.19
7	6	5	5.71	5.88	6.07	8-9	7	6	6.30	6	3.83

Thus it is seen that almost any of the common types of study may be used in the studying and establishment of incentives for clerical indirect labor. All of these standards were very costly to develop and took a great deal of skill and imaginations, yet most of the sources indicated that the incentives were saving them money, as much as a thousand dollars per worker per year after administrative cost, and extra earnings paid out.[16] All of which speaks well for one company's clerical incentive experience.

Methods of Determining Performance. Determining employee's

16. Brooks, p. 16.

performance must be a much easier process than developing the standards, because it is something to be done perpetually if the incentive plan endures. Basically, performance is calculated by applying the standards to the units of production to arrive at the earned or standard hours. These in turn, when divided by the actual hours of the individual or crew yield the performance of the individual or crew. Although, the final calculation is simple, many means of arriving at this calculation will be shown in this section.

In the aforementioned Pitney Bowes Plan (Plan No. 1) performance was determined by the clerical people entering their own units of production on the employees performance record shown in Figure 1.

From this performance record, accounting people apply the standards to come up with the standard hours, which when divided by the actual hours will reveal the performance of the individual. Table III shows a typical set of standards from an incentive prerate sheet.[17] On the consultant developed plan, being entirely on a group basis, standards are applied similarly, to the above plan, to yield standard hours, and others which do not, are shown in Table IV representing a typical incentive group.

Though appearing more complex, this calculation is still

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17. A prerate sheet is a form containing standards per variable unit, which when such units are entered and extended, will reveal the total standard per major activity.

FIGURE 1

EMPLOYEE PERFORMANCE RECORD

PERFORMANCE RECORD

Operator_____ Section_____

Date_____

Time	Job	Description	Unrated	Rated	Standard
		Starting Time			
		Totals			
				Efficiency	%

Form No. 2841

TABLE IV

CALCULATION OF PERFORMANCE

		Performance
1.	% Realization	72.2%
2.	% of Measurable hours covered	87.5%
		People
3.	Measurable	8
4.	Non-measurable	3
5.	Supervisory and Staff	2
6.	Total	13

		Hours
7.	Standard hours earned	215.6
8.	On incentive	280.0
9.	Lost time	20.0
10.	Not on incentive	
	a. Regular jobs	15.0
	b. Special Jobs	5.0
11.	Total	320.0
12.	Non-measured	120.0
13.	Supervisory and Staff	80.0
14.	Total hours paid	520.0

Computation:

$$\text{Line 1} = \left(\text{Line 7} \times \frac{\text{Line 7}}{\text{Line 8}} \left(\text{Line 10a} \times 10\text{b}\right)\right) \div \text{Line 11}$$

$$\text{Line 2} = \text{Line 8} \div \text{Line 11}$$

little more than earned hours divided by actual. In this measure however, the performance figures do not yield the incentive payment direct. Since budgeted performance standards can not exceed one hundred percent, significantly, if the standards are properly developed, a chart must be used to compute the incentive performance based on the per cent realization of the budget. Those hours not included as measured are, of course, paid the base rate.

The American Seating Plan (Plan No. 3) as a budget performance plan, looks at the dollars saved from operating at less than the budget. The amount of money that the crew receives is based on how much money is saved, with all "Middle Management" employees getting a percentage of the money. No performance percentage is calculated as such, but a sharing of the incentive pool basis is used. This pool distribution will be explained later in this Chapter in the section on distribution of earnings.

Periods of Calculation of Incentive Performance. Much of the effectiveness of an incentive is gained by the manner in which payments are tendered. In the earliest days of incentives when piecework was in vogue, workers would present their days production, or other reflections of the days production to the employer, and he gave the workers so many pennies per unit, or even fractional pennies per unit. Employers had the distinct advantage of knowing exactly what the labor costs were for a given step of the process. Workers were at the mercy of employers who may tighten the standard when workers became skilled or worked very hard, resulting in a new requirement of more pieces per hour.

Today, because of the complexities of products and the strengthening of labor unions, manufacturers are no longer able to tighten rates at will. Thus, management must develop incentive plans more carefully in order to avoid setting loose rates.[18] For direct labor, this is relatively easy with pre-determined time values and stop watch training methods, but for indirect labor, many of the measures used are more subjective. Many of these plans involve extreme complexities in measuring the period over which earnings are calculated.

Perhaps the most complex period of calculation of incentive earnings discussed thus far is that of the American Seating Company plan. In this budget yardstick plan the payment is based on a yearly basis with a quarterly prepayment of the yearly bonus. This payment was done to "tie the incentive reasonably close to the groups effort."[19]

The Pitney Bowes Plan (Plan No. 1) and the Consultant plan (Plan No. 2) both pay incentive on a weekly average of weekly performance, except for occupations in the consultant plan, which are suitable for daily performance calculations. These are classified as other than jobs "restricted to employees confined to desks and with a high degree of clerical proficiency."[20] For

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18. Loose rates are those that yield earnings in excess of those warranted by the performance.

19. Heidgen, p. 100.

20. Anonymous Procedures Manual.

these latter jobs, performance is calculated on a daily basis, averaging all days under standard as being one hundred per cent performance, Such a measure tends to raise performances, since poor performance days are not recognized, but this method recognizes days which the amount of work available is diminished and the workers would not be able to produce more if they wished to.. Close supervision must be supplied to assure that the workers do not save work to do on certain days, thus allowing for fantastically higher performances, which would yield exceptional weekly performances when averaged with the poor performance days.

Control of Earnings. Measures such as the above, prevent earnings from falling too low, when there is alikelihood of such an event. But what about earnings being too high. If the high payment is justified, it should be paid,, but not if there is a physical limit beyond which people cannot possibly work. Further, because of the method of calculation of performance and payment, overpayments would be made if controls were not established. The American Seating Plan (Plan No. 3) is the one most susceptible to such overpayments of any plan discussed thus far.

This is so because this incentive plan has its quarterly prepayment feature and the rules imply "The men are not, of course, required to return any portion of .. .. .. prepayment" and "At the end of the year, however,. all is forgiven and the participants all start the new year with a zero balance in the pool."[21] Over payment is avoided as much as possible by establishing a per cent

21. Heidgen, p. 100.

of potential hours payable, based on another control of maximum per cent of potential hours payable, based on another control of maximum per cent of hours that may be paid.. The maximum per cent of hours, when multiplied by the monthly payroll dollars indicates the maximum potential bonus dollars that may be paid. The pool dollars divided by the potential bonus dollars equals the per cent of potential bonus, payable. This is cumulated quarterly and the employees receive the potential bonus payable multiplied by the number of dollars in the pool. The table on[22] the next page (Table V) shows a hypothetical worksheet of the plan.

The quarterly cumulative total of line E represents the amount of bonus paid out. It is easy to see that if the balance of the year had poor performance, with the no returning of pre-payment rule, the employees would take home higher earnings than they are eligible for. If the plan were on a three month payment basis, whatever earnings would be attained, would rightfully belong to the employees,, and if the company operated at a loss the rest of the year, the employees would receive their base rate in much the same sort of way as the consultant daily basis plan, except that the calculation period is much greater. Management gains an edge in having maximum potential earnings, allowing them an extra margin of profits if cost performance has been excellent beyond the point of the potential bonus. Once the potential bonus has been achieved, the entire proceeds of the

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22.. Ibid,, p.. 99.

TABLE V

HYPOTHETICAL WORKSHEET

(00 omitted)

Refer. to Text		FIRST QUARTER			SECOND QUARTER		
		Jan.	Feb.	Mar.	Apr.	May	June
Line A	Std. Budget (all fact. dir. and indir. costs).	$1000	$1000	$1200	$1000	$1100	$1200
Line B	Actual Costs	900	1050	1000	960	1000	1000
Line C	Savings or Loss (C-A-B)	100	(50)	200	50	100	200
Line D	Amount cred. to partic. pool (D= 50 X C)	50	(25)	100	25	50	100
Line E	Cumulative Pool	50	25	125	150	200	300
Line F	Cumulative Poten. Bonus	100	200	303	406	509	612
Line G	% of Poten. Bonus Payable (G= E / F)	50%	12½%	41%	37%	39%	49%

budget performance is retained by management.

Distribution of Earnings. The American Seating Incentive (Plan No. 3) is unique in its division of the incentive pool:

> One-half of the variance is credited to the incentive pool (Line D)(previously illustrated) . . . /Table V/ It is based on the assumption that 50% of the savings made through the cost reduction efforts of these men is reasonable and sufficient incentive for them to work towards those savings.
>
> This "50% of savings" then, is put into a pool every month. Notice line E . . . The pool is cumulative. Actual costs in January were $10,000 under standard costs. Half of the savings ($5000) was put into the pool. In February, actual costs were $5,000 in excess of standard. So half of the loss of $2,500 was deducted from the pool, making the cumulative pool for the first two months only $2,5000. In March, savings amounted to $20,000, so $10,000 was added to the pool. It brought the cumulative pool to $12,500. That, then, is where the incentive money comes from.[23]

This pool is then distributed to three groups "depending upon the effect a man in a given job may have on costs."[24]

> There is a 35% group--eligible for incentive pay up to a maximum of 35% of their base salary. This group includes such men as production superintendents, plant engineer, the chief industrial engineer. About 10% of the participants fit into this group.
>
> There is a 25% group principally of foremen, but including methods engineers, office supervisors, etc. It is by far the largest group, includes about 75% of the participants.
>
> Finally, there is a 15% group largely of office staff people who have the least potential effect on costs. The remaining 15% of the participants are in this group.[25]

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23. Ibid.

24. Ibid.

25. Ibid., p. 98.

These categories were based on examination of job descriptions using objective criteria as the determination of an individuals effects on costs.

The other plans mentioned in this chapter all pay either the same percentage of incentive earnings to all members of a group incentive, or the particular individuals incentive earnings where he is on an individual incentive basis.

CHAPTER III

INCENTIVES FOR INDIRECT JOBS IN THE FACTORY

Levels Included. Everyone thinks of factory workers as people who make things. From the distance this istrue. A distant look into a factory reveals many people busily, physically engaged. Stepping in closer one sees that they are not all making the product. Some are unloading raw material from a truck in a receiving department, others are delivering it to the stock room. There, people are stocking or pulling material from stock to be delivered to the floor, a man may be seen material handling to the manufacturing floor, another may take the material and place it in stock trays or shelves at a worker's station. Perhaps, the workers machine is being repaired, after which a janitor cleans up the mess. When the product is made, people must test or inspect it to make sure that it is up to satisfactory quality standards. Then a material handler takes it to be packed and shipped or to another stock room for ultimate packing and shipping.

All of the above occupations have nothing to do with making or shaping the product, yet take them away and the factory will cease to operate. All of these operations are essential in virtually every factory. They are the people to whom the least attention has been paid over the years. They are the arteries of the factory through whom the life blood of the manufacturing runs.

They are the indirect labor in the factory. Table VI details the occupations covered in this chapter and the pages on which the various types of plans and occupations will be covered.

TABLE VI

INCENTIVE PLANS DISCUSSED IN THIS CHAPTER

Plan No.	Occupations Covered (Company)	Page References
5.	Janitor (Industrial Engineering Handbook)	39.
6.	Inspecters (ITT-Kellogg)	39, 46.
7.	Testers (ITT-Kellogg)	39, 47, 59, 64.
8.	Material Handler & Set Up (Anonymous Communications Company)	40, 48, 68.
9.	Packing and Shipping (Avon Products)	37, 43, 59.
10.	Steel Loading into Barges (Anonymous Steel Company)	33, 35, 42, 57.
11.	Scrap Handling (Anonymous)	33, 36, 42, 58.
12.	Utility Generating(Anonymous)	37, 45, 60.
13.	Maintenance (U. S. Navy, T. H.)	41, 49.
14.	Maintenance (Bay States Abrasive)	41, 50, 61, 62, 64, 68.
15.	Maintenance (Union Carbide)	41,
16.	General Utility Crew (Anonymous)	41, 52-57, 63, 65, 66.

> There's a well established trend toward a higher ratio of indirect to direct labor. If this is true of manufacturing in general, then it's true of the majority of plants. That means it's on its way to you if you haven't already noticed the change in your plant.. Now if work measurement is to continue to be a useful tool for the control of production and costs, its application to indirect work has to increase.[1]

In a recent survey by Factory magazine of seven hundred and eighty-five plants in various types of manufacturing, the answers to many incentive questions were indicated to show the quantity and nature of direct and indirect incentive coverage. Table VII shows the percentages of employees in various occupations that are covered by measurements based only on plants that actually use labor measurement, only three hundred and two of the seven hundred and eighty-five in the survey.[2]

This chapter will show several different incentive plans for the coverage of maintenance based on the experiences of several companies treatment of the most indirect of indirect groups to be discussed.. Material Handling crews for more repetitive and less repetitive types of work will also be discussed.. A packing incentive and normally thought of as impossible-to-measure inspector incentive and a testing incentive will also be included. Unique steel loading into barges (Plan No. 10) and scrap handling (planNo. 11) with cranes will be covered in this chapter. Assorted utility generating stations (Plan No. 12) will also be

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1. Robert S.. Rice, "The Truth about Wage Incentives and Work Measurement Today," Factory, CXVII(April 1959), 76.

2. Ibid. p. 74.

mentioned briefly. Nearly all of the incentives to be covered are of the crew type. A discussion of the merits of a crew incentive versus individual incentive will be included in the section on the distribution of earnings.

TABLE VII

PER CENT OF VARIOUS OCCUPATIONS COVERED IN PLANTS THAT USE INCENTIVES

Base= 302= 100%	% Of Plants That Measure
Direct:	99%
Indirect:	
Materials Handled	33%
Receiving and Shipping	36%
Tool and Die Service	11%
Inspection	35%
Housekeeping	14%
Maintenance	13%
Other:	
Clerical Shop	5%

Yarksticks of Production. The selection of a yardstick of production that is reflective of the crews efforts is far more difficult for the indirect jobs in the factory, than it is for the direct jobs. In the case of the direct jobs, the worker is actually touching the product and it is generally far more repetitive. With the indirect workers,, this isn't necessarily

the case. Direct measurements are greatly preferred to indirect measurements since they tie the work produced more closely to the individual.[3] However,, direct incentives are not always so easily developed for indirect groups because of the unrepetitiveness and general remoteness of the work.. Both direct and indirect yardsticks will be discussed in this section.

The first yardsticks to be discussed are two incentive plans using the direct type of measurement.. The repetitiveness of the operations readily allowed this type of measure to be used. These plans are in existence in a large steel company whose engineer requested that neither his name, nor the company's name be used. One of these two plans is an incentive covering loading crews engaged in the loading of barges (Plan No. 10) with various semi-finished steel products and unloading of bulk raw materials:[4]

Units of Production

A. The standards for loading product to barges or boats are based upon the units of lifts of material loaded according to type and size of product and type of barge or boat.

B. The standards for unloading raw materials are based upon the units of 100 tons of material handled according to type of material and lifting device used.

C. The standards per barge are based upon the number of barges loaded or unloaded classified by type of barge cover and whether started or finished.

D. The standards for turn preparation are based

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3. See p..l..n..

4. Anonymous Incentive Application Standards Manual.

upon the crane hours worked during the pay period.

Thus we see number of lifts of product,, 100 tons of material, type of barge loaded, and crane hours worked as the yardsticks of production in this plan. The other plan based on a similar type of yardstick is for a scrap and bulk material (Plan No. 11) crew as well as the providing of general plant crane service:

Units of Production

A. Standards for loading or unloading available and unavailable scrap,, bulk materials for steel additives, limestone and miscellaneous items are based upon the units of standard gauge railroad cars, narrow gauge cars and trucks, classified by type of material, crane and car or truck.

B. Standards for loading or unloading stock usable ingots molds and stools are based upon the units of pieces and classified by type of crane,, material and size.

C. Standards for turn preparation are based upon the actual hours worked during the pay period.

D. The standard for general plant service is based upon the unit of 100 ingot tons produced in the Open Hearth and Electric Furnaces.[5]

This latter incentive being of a more diversified crew in its activities,, has the unique feature of combining direct and indirect measurements into the same incentive plan. The first three measures above, a, b and c are based on work actually performed by the crew. The last yardstick is one over which the crew has virtually no control. The measure of 100 ingot tons was

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5. Ibid.

used as a general reflection of the level of overall plant activity in all production divisions. A certain number of 100 ingot tons reflected a certain number of direct producing units operating thus yielding the required quantity of this incentive crews services being needed. This portion of the incentive based on a somewhat wild yardstick accounts for less than 10% of the crews hours, thus does not weigh heavily in the determination of the crews performance.[6]

Another incentive based entirely on the direct units of production of the indirect crew is that of the packaging crew at Avon Products (Plan No. 9), Morton Grove, Illinois. With the diversified items used, complicated by having to fill orders for one hundred thousand housewife salespeople, the units of "Orders," "Items" and "Working (from table)," were used as the yardsticks of production. Averages of sizes and types of orders were used as the basis of standards developed by the Work-Factor predetermined time value system. This development will be discussed in the section of this chapter covering methods of measurement or developing of standards.

A direct measurement of a completely different type of crew is used in the aforementioned steel company's electricity producing unit (Plan no. 12).

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5. Ibid.

6. A. Helderman, "How to Apply Work-Factor Standards to a Final Assembly and Packing Function," Unpublished speech delivered before the Work Factor Associates, Chicago, Illinois (May 1959), 2.

Units of Production

A. The units of production for the equipment time values are the units of total gross MKWH generated classified by engine groups.

B. The units of actual operating hours are required in calculating equipment performance..

C. The units of production for the work time values are the total gross MKWH generated.[8]

This plan is different from the others previously mentioned, in that it combines equipment performances, developed from items a and b with work performance c to measure the crew's performance. Normally, equipment performance is only thought of in terms of direct crew applications, because a machine or "equipment" usually indicates that a product is being made.. However,, in the production of steel, electricity production is only indirectly related. Thus, we have this crew being classified as an indirect one. It would be correct to state that where the final product is electricity as in an electric company,. this crew would be considered as the direct crew. But as a sidelight,, think of how few direct people there would be in such an industry. All of the billing clerical, maintenance,. meter readers and construction crews would be the indirect labor and would probably consitute a major percentage of the number of people actually employed. Similar direct measurements of indirect crews would exist in this steel company's generating of other types of utilities.

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8. Anonymous Incentive Application Standards Manual.

The Electronic Products Department of the Kellogg Division of International Telephone and Telegraph Corporation used direct measurement of the number of units inspected (Plan No. 6) or tested (Plan No. 7) as the basis for incentive payments. Pre-rate sheets are used to determine the number of connections inspected or tests performed to provide a measurement for these indirect groups.[9]

Industrial standards are given by various cleaning material companies for use in the development of directly measured incentive standards for janitor crews. Such data is available as time required for sweeping (restricted), sweeping (unrestricted), mopping, restricted and unrestricted, cleaning commodes, cleaning sinks, waxing floors, buffing floors, etc. Unfortunately, the writer was not able to avail himself of this material at the time of writing this thesis, so further discussion will not appear on the subject of this type of measure for Janitors and Cleaners. Standards, as mentioned above, unsubstantiated by back up data do appear in the Industrial Engineering Handbook (Plan No. 5).[10]

Since there are many indirect occupations that do not readily lend themselves to direct measurements, indirect measurements must be used, if workers are to be covered by incentives. One such application is that covering a material handling and set-up group

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9. Work Factor Standard Data, Kellogg-ITT.

10. C. W. Funton, "Measurement of Storeroom, Janitor, and Shipping and Receiving Work," Industrial Engineering Handbook, ed. H. B. Maynard (New York, 1956), p. 3-201.

(Plan No. 8) at an equipment company which wishes to remain anonymous. In their incentive, the yardsticks of production are "expressed in terms of standard hours of indirect work per standard (produced), hour of direct work."[11] This was felt adequate as an incentive yardstick since the quantity of work performed by the direct crew causes a related quantity of work by the crews who supply and remove the material to be worked on. Using standard hours, rather than actual hours of the direct crews causes the indirect workers to realize that if an operator is delayed by not having material to work on or a backlog clogging their work areas, the direct performance or standard hours will be reduced, and the yardstick quantity will be diminished.

The subject of maintenance is perhaps industry's greatest hard-to-control expenses, yet it does nothing toward making a profit. Nothing directly, that is. Naturally the direct crews requirements for properly functioning equipment and the factory layouts are strongly felt, but it is the indirect crew of maintenance that most satisfies these needs. Thus we have probably the grandest, largest indirect crew of them all, the maintenance crew.

In the quest for control of this industrial profit eater, considerable imagination has been shown in the development of measures of performance used as the basis of incentive performance. Yardsticks of both the direct and indirect type of measurements

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11. Anonymous Incentive Establishment Guide.

are used for maintenance crews, ranging from detailed standardized task lists, having a set standard for each of several types of activities (Plan No. 13),[12] through counts of the number of jobs done (Plan No. 14),[13] job estimates (Plan No. 15),[14] and finally the bases of standard indirect hours being earned by a relationship to standard direct hours as used in the foregoing material handler and set-up occupation incentive. The yardstick used for a general utility crew (Plan No.16) is a fantastically complex incentive based on the earned standard hours of approximately two hundred different direct incentive crews varying from prosperity to recession levels of operation.

Methods of Measurement or Development of Standards. Since virtually every type of yardstick[15] is used in the area of incentives for indirect labor in the shop, every type of incentive standard development is used, including all of those mentioned in the section of chapter II dealing with the methods of measurement or developing of standards. The manner of transcribing the raw data developed into incentive standards for the indirect labor in the factory group will be discussed in this section.

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12. J. U. Saum, "Industrial Engineering in Maintenance", Industrial Management, (February 1959), 6.

13. A. M. Robinson, "How to Gage Maintenance Output", Factory, CXVII (February 1959), 220.

14. C. Gordon Saunders, "Chart Your Way to Better Maintenance", Factory, CXVII (December 1959), 149.

15. A yardstick is differentiated from an method of measurement in that a yardstick is that which is measured against, while the method of measurement is how it is measured.

The first standard development to be discussed is that used in the aforementioned steel loading and scrap handling incentives (Plan Nos. 10 & 11). Timestudies were taken, detailing the required times to do loading and unloading operations of the various times handled, noting the size of the material, weight of material, delays and other characteristics of the job including required crew size, distances traveled to load or unload, and factors of fatigue. After determining average time for like elements of similar material, and averaging delays from the studies as well as historical delay reports, the standard formula was applied.[16]

$$\text{No. of crew Members} \left(\text{Cycle Time} \right) - 1.00 \text{ less std. allow.} \left(\begin{array}{l} \text{Normal times of crew} \\ \text{Members with Rest and} \\ \text{personal allowance} \end{array} \right) =$$

Standby Time / Normal Times = Standard Time

Standard Time / Delays = Standard Time Value

The standby allowance developed in this calculation is required since a good deal of standby time is incurred due to the nature of the work. These standards cover a crew of a craneman, switchman, minimum, up to two cranement, two switchmen and four hookers, maximum. When the hookers are used, two are located in a railroad car and two are located in a barge being loaded, thus, when the crane or cranes are at the barge, the car hookers are idle and vice versa.[17] It is in this situation that the

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16. Anonymous Incentive Development Directive.

17. Anonymous Incentive Application Standards Manual.

standby time would be the greatest. Capacity performances for the standards is always lower when there is a good deal of standby since standby time is included in the standard calculation at one hundred per cent. Basically, the worker cannot work if he wishes to, nor can the company provide any work to do for these relatively short spans of time. Naturally, if a man could work all of the time, he has the opportunity to make a higher performance than if he were not allowed to work. This principle is labelled as a restricted job.[18]

The indirect measure of the scrap and bulk material crew was developed by taking the historical crew hours charged to the direct producing facillities over a period of time in the plant, normalizing them at an arbitrary, but equitable percentage and dividing them by the one hundred ingot tons produced in the plant over the same time to derive the standard hours per one hundred ingot tons. Any improvement over historical performance would be entirely credited to the crew.[19]

The Avon Products plan (Plan No. 9) developed its incentive standards through the use of Work-Factor, coupled with standard size, distance and order size averages. The elements of work performed by an operator in filling an order are as follows:

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18. A restricted job is one on which the work of the employee is subject to equipment, process or other operation limits, or, in which the nature of the operation limits the performance of the operator.

19. Anonymous Incentive Application Standards Manual.

1. Picking up and unfolding the order blank.

2. Looking for the first item ordered.

3. Picking item from shelf and placing in tray.

4. Looking for and picking the next item ordered, etc. until all items ordered from her section have been assembled.

5. She will then fold up and replace the order blank and push the trays to the next assembler and walk to the front of her section for the next order.

6. When a carton of merchandise has been emptied, she will remove the carton from the bin and place it on the conveyor where it will be removed at the end of the assembly line.

Certain of these elements occur only once per each order handled regardless of the number of items ordered, others occur once per each individual item ordered. We must therefor make a distinction between the two, also, because of the length of each section must vary, it is necessary to consider walking as a separate element. Thus we have the three major variables, order variables, item variables, and walking.[20]

Development of standards was made by detailed Work-Factor analyses of the aforementioned items one through six. For item four, analyses were made for each size range of products for which a significant time difference would be incurred. These times were then weighted, to arrive at the average item time. Only when a grand scale push of a single item was in effect, was a deviation from the average used. In that event, the actual analyzed time was used as the basis of the standard for that item, with new averages being developed.[21]

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20. Helderman, p. 2.

21. Ibid.

In the electricity generating incentive (Plan No. 12), standards were developed by making ratio delay (work sampling) studies of the performance of the crew. These studies consisted of checks made at predetermined random times to reconstruct what the various power plant workers do during their day, and how much idle time is incurred. By the ratio delay or work sampling method, elements may be statistically checked based on the frequency of their occurence to reveal the statistical level of probability. The theory operates in the same manner as an opinion population sample:

> Let's take a simple example to see how it works: Assume we want to find out how much time a selected machine spends on operations, set-up, maintenance, and delay.
>
> Using the ratio-delay technique, we visit the machine a predetermined number of times a day, say 10. That doesn't mean every 48 minutes during an 8-hour day. That wouldn't be random sampling. We want 10 random samplings during the day that follow no set pattern. We record which element is occuring at the instant of each visit. At the end of 10 days the record may read:[22]

TABLE VIII

WORK SAMPLING STUDY

	Observations	Per Cent of Total
Operation	60	60%
Set-Up	18	18%
Maintenance	10	10%
Delay	12	12%
Total	100	100%

22. Harry Lee Waddell, "Work Sampling", Factory, CXII (Oct, 1954)

If this were an adequate size population to represent conditions, the reader could assume that if continuous studies were made in the area the probability of similar percentages of the elements occuring would be very good.

After the work sampling studies were made and allowances added to each element on the basis of the effort involved, engineering calculations of what the equipment was designed to do in the way of production, were analyzed. After suitable allowances for outage time for repairs, a figure of 100 per cent capacity was developed. Actual engine performance was determined for the time that the ratio delay studies were made to determine the required crew performance at a given of engine efficiency. From the calculation of work hours divided by number of MKWH produced, the standard time value for work performance was developed. This was done by equipment groups where significantly different equipment capacities were involved, yielding a few standard time values to be applied depending on which engines would be operated.

Equipment performances and capacities were developed to show the standard hours per MKWH produced. Thus the basis is established for calculating any future performance of the crew.[23]

The Kellogg-ITT Inspecter incentive plan (Plan No. 6) was developed by the Work-Factor method,, similarly to the Avon plan mentioned previously. Each element involved in inspecting an

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23. Anonymous Incentive Application Standards Manual.

electronic assembly was detail-analyzed and averages developed for similar items.. The elements considered included visual inspection of soldered connections,. checks with screw drivers or wrenches for tightness of mechanical connections, writing of rejection or stamping of acceptance tickets, based on average faults that may be expected per unit, and other items peculiar to the operation. Pre-rate sheets were developed whereby every time a new type of unit was to be produced, all that would be necessary for the Industrial Engineer to do, to have a new standard, was to count the number of soldered connections, mechanical connections, etc. After this, by applying the pre-rated time per connection, he would have the standard for the new unit. This could be done from circuit diagrams eliminating any need for unmeasured work,. until the standard comes out to the worker.[24]

The testor incentive (Plan No. 7) was developed on the same basis as above, except that various meter readings, dial adjustments with knobs, switch throwing, pluggings, unpluggings, recordings with similar pick-ups and asides were used. Additional breaks in the pre-rate sheets were added to allow a lesser standard where units were put aside when a defect was found that prohibited further testing of the unit. This condition was not prevalent in the inspection incentive, since operation of the unit was not a criteria of the job. No incentives had been developed yet for trouble-shooting the sets put aside since the variety

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24. Work-Factor Standard Data, Kellogg-ITT.

of troubles was too varied and the quantities of a given unit were generally too small. Although a prescribed troubleshooting path could have been developed, it would have hampered the operator's skills since trouble-shooting is a science varying with the location of where the operator got his skill and training.[25]

Standards were developed for the material handler and set-up group (Plan No. 8) on the basis of the relationship of earned standard hours of the direct crew to required hours of the indirect crew. Work sampling studies were made to determine the performance of the indirect crew and the number of hours spent in each department. When performance was established, the required hours for each department was determined. The standard hours earned by the direct crew was then divided into these required hours plus allowances to derive the earned standard hours of the indirect crew per earned standard hours of the direct crew, or in short, the incentive standard to be applied to the particular department.[26]

This type of standard development is fairly common, but it is interesting to see the comment that Phil Carroll, noted incentive authority has about this exact type of measurement of set-up men. "This sort of incentive 'formula' is commonly used to pay more money to set-up men. But what many overlook is that often, when the set-up man works, the operator is idle. Then when the oper-

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25. Ibid.

26. Information derived from source who wishes to remain anon

ator takes over, the set-up man is idle. Obviously, the productivity of the operator is not a measure of the set-up man's contribution!"[27]

Since in the situation studied there are about four to five material handlers to each set-up man, and the fact that the "operator is idle," as Mr. Carroll says, means that the operator can only attain one hundred per cent performance, as base rate less direct hours can be applied to the standard. This would be a major contribution toward lower performance for the indirect workers. Thus, he could raise his own performance by getting the operator back to work more quickly. Bearing these facts in mind, there is little enough harm in using this ratio type incentive in this particular application.

Considering the mass of yardsticks used in measuring maintenance crews, standards were found developed in every imaginable way. One company used a ratio method and work sampling similar to the previously mentioned material handler set-up occupation incentive.

The United States Navy at Pearl Harbor (plan No. 13) used what it called "Engineered Performance Standards"[28] in which allowances for delay and fatigue were added to expert bench mark standards to develop standards for various types of activities.

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27. Phil Carroll, Better Wage Incentives (New York, 1957), p. 90.

28. Saum, p. 6.

The Bay State Abrasive Products Company (Plan No. 14) of Westboro, Massachusetts based its incentive plan on the historical time required for maintenance work.. The average times used for jobs were broken into groups of less significant time differences. From these groups the average actual time spent on the jobs of the group was derived. By counting the actual number of work orders or jobs performed in the group, the percentage of all the jobs done was derived. This percentage multiplied by the average time of the group yielded the incentive factor for the group.. These factors when totalled yielded the over-all standard for the crew.. Incentives were based on a fifty-fifty split of extra work between the incentive crew and the company, if performance earnings were over the historical performance.. The following illustrations show the actual summary data for the incentive standards:[29] (Tables IX and X)

This incentive is equitable with its fifty-fifty split in that it recognized that past performance of the crew may have been well under one hundred per cent, as it is in most unmeasured operations. Also, a crew going on incentives with limited methods descriptions, as existed here, can devise all sorts of short cuts. Such short cuts are normally dictated by management and most union contracts recognize management's right to improve the way in which the job is done. Management is fortunate here in

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29. Raymond H. Tolman, "Simpler Maintenance Incentive," Factory, CXVII (March 1959), 170-171.

TABLE IX

HOW BASIC DATA ARE DERIVED

Period Tested	Job Times (Hours) 0.1-1-9	2.0-3.9	4.-7.9	8.-15.9	16-31.9	32-49.9	50&Over	Grand Totals
				A -- Total Hours				
3 Months	1396.7	1540.0	2324.5	2606.1	3063.9	2606.0	10823.7	24360.9
3 Months	1352.8	1589.0	2216.8	3084.2	3447.8	1894.9	7766.0	21351.5
Total	2749.5	3129.0	4541.3	5690.3	6511.7	4500.9	18589.7	45712.4
				B -- Number of Jobs				
3 Months	1509	559	420	238	137	67	108	3038
3 Months	1443	571	396	279	155	49	80	2973
Total	2952	1130	816	517	292	116	188	6011
Average	1476	565	408	259	146	58	94	3006
				C - Average Job Time in Hours				
3 Months	.93	2.75	5.53	10.95	22.36	38.90	100.22	
3 Months	.94	2.78	5.60	11.05	22.24	38.67	97.07	
Average	.94	2.76	5.56	11.00	22.30	38.78	98.64	
				D. - Percentage of Total Jobs Done				
3 Months	49.67	18.40	13.82	7.83	4.50	2.21	3.55	
3 Months	48.54	19.21	13.32	9.83	5.21	1.65	2.69	
Average	49.10	18.80	13.57	8.60	4.85	1.93	3.12	
				E - Percentage of Time Spent in Each Group				
3 Months	5.73	6.32	9.54	10.70	12.58	10.70	44.43	
3 Months	6.34	7.44	10.38	14.44	16.15	8.87	36.37	
Average	6.03	6.88	9.96	12.57	14.36	9.78	40.40	

TABLE X

HOW RATES ARE SET UP

Group	Rate (hours)	% Jobs Done	Factor
0-3.9 Hours	1.44	67.90	0.98
4-7.9 Hours	5.56	13.60	.76
8-15.9 Hours	11.00	8.60	.95
16-31.9 Hours	22.30	4.85	1.09
32-49.9 Hours	38.80	1.93	.75
50-Hours and up	98.60	3.12	3.08

having the workers find the short cuts and applying them. This saves industrial engineering methods time. Although management improvements are made and recorded, no change in the rate had been made in the four years since the plan was installed. Proof of the degree of success in the plan lies in the statement, "First, it hasn't been too tight a rate because the men have continuously made a fair bonus. Second, it hasn't been too loose because work sampling observations indicate the men still have to do a fair day's work to earn bonus."[30]

The final plan to be included as an illustration of the development of standards is the steel company plan for a utility producing division (Plan No. 16). The development of this incentive describes a conception that required nearly two years until the plan reached installation. The plan encompassed the drawing-off and analysis of hundreds of thousands of figures and is an

30. Ibid., p. 174.

outstanding reflection of the usefullness and maintenance of good historical records. The steps of development are outlined in the following manner:[31]

1. From the standard cost utilities budget was determined the quantities of utilities provided to each direct producing unit by percentage (utilities furnished to indirect functions were either associated to the most closely associated direct producing facility or pro-rated over all divisions, reflecting the general level of plant operations). This was done for each utility, whose people were to be included in the plan.

2. From the Power Division actual hour report, the number of hours worked by each occupation in each facility were obtained.

3. Actual Power division hours were considered in the light of Power Division crew schedules to determine which occupations are fixed in so far as the occupation being required at certain levels of operation, and which were variable, diminishing in direct proportion to a pre-established condition.

4. Power Division Maintenance charges, by facility charged, and outside maintenance hours for occupations which also appeared in the maintenance crew were obtained, making allowances for appropriation work. Appropriation work was considered as special jobs not normally falling in the scope of work performed by the maintenance crew. Outside maintenance hours were considered, since these constituted extra hours provided as assistance for the crew.

5. Total Power Division hours were developed for the crew to be included in the plan at the current average, reference period level of general plant operation.

6. Standard company allowances were applied to the Indirect Actual hours after applying the performance factor developed from ratio delay studies, to derive the Power Division required hours or the ref-

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31. This information has been explained in much detail through the courtesy of the Industrial Engineer who developed this plan and his company. It is their request to remain anonymous.

erence period level of operation.

7. Required hours were multiplied by the percentages derived from the foregoing paragraph 1, to yield the required number of power division hours for each direct producing division for the reference period.

8. For the Direct Crew levels, the average operating levels of each direct producing division was established, to include such things as number of blast furnaces operating, number of furnaces in each steel producing facility, number of rolling mill turns (shifts) for rolling mills, and operating hours per pay period for conditioning facilities. Mill turns (shifts) for non-incentive groups were established and related to 100 tons of production at a given level. Ultimately, the determinant of 100 tons would be used for incentives in such non-incentive area, at which time appropriate changes would be made in the indirect incentive to reflect only the change of conditions of the direct crew.

9. The crew schedules of the direct producing facilities were noted to provide the basis of determining the direct crew hours and various levels of operation by individual producing division.

10. Actual hours for the direct crews were established from payroll records.

11. The index of measured performance (Incentive performance) was established for each direct producing division for the reference period.

12. The Earned plus Unmeasured hours of the direct crews were established from incentive and payroll records.

13. Actual hours derived in section 12, above, were compared to the actual crew schedule hours, derived from section 9 to show the relationship of actual hours to crew schedule standard hours.

14. By using a fact or developed in 13, above, multiplied by the crew schedule standard hours, the actual hours to be expected at any level was derived.

15. The actual hours per level of operation multiplied by the reference period index of performance yielded the earned plus unmeasured hours that may be expected at any given level of performance, where the direct crews would be working at the same effort.

16. The required standard indirect hours developed in paragraph 7, above,, divided by the direct earned standard plus unmeasured hours at the appropriate direct crew level of operation yielded the incentive standard for requirements to a given direct producing unit at a given level of operation to provide the source of the earned indirect standard hours.

The following illustration will show a series of sample standards developed. The figures used are purely ficticious in order to assure the anonimity of the source:

TABLE XI

INDIRECT INCENTIVE DEVELOPMENT

BLAST FURNACE DIVISION

Utility	1. % of Utility To Bl. Fce. Division	2. Total Crew Hours Worked	3. No. Fixed
X Power	.2000	240	All
Y Power	.3300	160	"
A Gas	.4000	160	"
B Gas	.3400	240	"
Water Pumping	.6550	80	"

4. Facility Mtce. Hours	5. Total Crew & Mtce. Hours Per Facility	7. Facility Hrs to Blast Furnaces
120	360	72.0
80	240	80.0
160	320	128.0
380	620	211.0
700	780	511.0
		1002.0

6. Assume that 1002.0 was the maintenance hours required after allowances. Special consideration was made of performance where crew hours were fixed.

8. 6.8 furnaces determined to be reference period average operating level for reference period, using 10,000 actual hours

TABLE XI (Continued)

INDIRECT INCENTIVE DEVELOPMENT

AT 110% performance (capacity for direct plans 120% in this division).

8. Avg. No. of Fces. Per Pay Period	9. Crew Schedule Hours (Calculated)	10. Total Hours
6.8	9600	10,000

11. Average Performance	12. Bonus Hours
110%	11,000

11,000 Earned Incent. Hrs. / 120% Capacity Performance = 9167 actual hours at capacity for 6.8 furnace level of operation

13. 9167 actual hrs. 6.8 Fces. / 9600 Crew Schedule Hrs @6.8 = .955 factor of actual hours as compared to crew Schedule hours

Furnace Level	9. Crew Sched Actual Hours	14. Factor. 955 X Crew Sched. Hrs.	15. Earned + Unm Hrs at Ref. Pd. Lev
7.0	10,000	9,550	10,595
6.0	8,500	8,117	8,929
5.0	7,300	6,971	7,660
4.0	6,000	5,729	6,302
3.0	4,500	4,297	4,727
2.0	3,000	2,865	3,152

7. Indirect Crew Hours	16. Ind Crew Hrs. + Dir E + U Hrs. = Std Time Value
1,002	.095
1,002	.112
1,002	.131
1,002	.159
1,002	.212
1,002	.318

Methods of Determining Performance. A performance calculation formula is shown for the last mentioned incentive described in the preceeding section, the utility producing division of a large steel company (Plan No. 16).

TABLE XII

CALCULATION OF PERFORMANCE

Division	Level Of Operation	Std. Time Value	X	Dir Earned / Unmeas Hours	=	Earned Std. Hrs.
Blast Furnaces	7.0 Fces	.095		12659		1201
Open Hearths	18.0 Fces	.112		10650		1193
Rolling Mill A	20 Shifts	.100		8400		840
Rolling Mill B	1f Shifts	.050		16000		800
						4034

Actual Hours of Indirect Work - 3600

$$\frac{\text{4034 Earned Std. Hours}}{\text{3600 Actual Hours}} \times 100 = 113\% \text{ Performance}$$

The steel loading crew performance (Plan No. 10) is calculated by determining the quantity of the lifts that the mill which rolled the material used to load the railroad car. The mill, being on a tonnage basis incentive, attempts to load the steel in the fewest number of (safe) lifts possible. These lifts are then multiplied by the appropriate incentive standard to derive the standard hours for the lifts made. Standards are similarly applied to bulk material unloaded on the basis of actual tons, verified by certified scales and invoice weight for purchased new

material. Next, the crane hours worked are multiplied by the standard for crane service. Then an allowance is made for the barge itself, based on the types of covers used. All of the earned standard hours are added up for the incentive pay period and divided by the actual hours worked during the pay period to derive the incentive performance, Performance is calculated by crew shifts and by barges, which may have taken several shifts, but this is done only to determine weaknesses of the operation. The scrap handling crew(Plan No. 11) is based on the application of the standards to Foremen's reports of the type of material handled and the railroad car numbers. Since averaged weights are used for different types of cars, no weights are requested. Standards are also applied to certain items actual counts, such as ingots, molds and stools. Turn preparation standards are applied to the crane actual hours used. The plant daily report of operations is the source of the one hundred ingot tons used as the basis of standard hours for general plant service. A ficticious scaled down, daily performance would appear as follows:(Table XIII)

Total one hundred ingot tons 3.5 @ 2.0 standard hours per one hundred tons= 7.0 Earned Standard hours for the crew. Assume: crane shown is total crew for illustration purposes.

Total Standard hours for cars	9.6
Total Standard hours for turn prep	1.6
Total Std. Hrs. for Plant Service	7.0
Total Standard Hours	18.2

$$\frac{\text{Total Standard Hours - 18.2}}{\text{Total Crew Hours Worked 16.0}} \times 100 = 114\% \text{ Performance}$$

TABLE XIII

FOREMAN'S REPORT

Crane Operator: 31-106 Date: _____

Signalman: 31-290

Mat'l Handled	Hrs. Spent Cr.	Hrs. Spent Sig.	Cars Loaded or Unloaded	Tot. Cars	Std.	Std. Hrs.
No. 1 Scrap	2	2	(L)RI 6857,CB&Q1834	2	2.4	4.8
No. 4 Scrap	1½	1½	(U)NYC 4449	1	2.6	2.6
Unavailable Hvy	1	1	(U)PRR86104	1	2.2	2.2
Move 2 B Frames to Bl.Chg.	3½	3½				9.6
	8 Crane Hrs.			8Hrs.	.20	1.6

Approved: _____
Shift Foreman

The Avon Products Company incentive for packers (Plan No. 9), the Kellogg Inspecter Incentive(Plan No. 6), and the Kellogg Tester (Plan No. 7) all record production counts of the various yardsticks. Incentive standards shown in terms of pieces per hour instead of hours per piece, thus the calculation made to determine quantity of payment or incentive performance, is as follows:

$$\frac{\text{Pieces or Units Produced}}{\text{Standard Pieces Per Hour}} = \text{Produced Hours (Earned Hours)}$$

Payments are actually made on produced hours although an index of performance would be developed by the standard formula

of produced hours divided by actual hours times one hundred equals the index of performance.

The performance calculation for the electricity producing group would be as follows:

TABLE XIV

PERFORMANCE CALCULATION

Assume the following conditions for a pay period:

(a) Total hours of crew 400

Work Performance Calculation	No. of Units Pay Period	Work Perf. Std./Unit	Total
Actual gross MKWH Gen.	3000	.100	300

Work Performed = $\frac{300}{400}$ = 75%

Equipment Perf. Calculation

Engines 1 through 3 2000 MKWH X .150 Std. Hrs./mkwh	=	300
Engines 4 through 9 1000 MKWH X .200 Std. Hrs./mkwh	=	200
Total Standard Engine Hours		500

Per Cent Equipment Performances

$$\frac{\text{500 Total Standard Engine Operating Hours}}{\text{496 Total Actual Engine Operating Hours}} \times 100 = 100\%$$

At this point, the work performance @ 75% would be cross referenced to an equipment performance of 100% to yield the incentive performance.

Similar plans to that previously mentioned also exist for other divisions of the utility department in this company.[32]

Performances of the maintenance incentives would be calculated similarly to those incentives mentioned previously where the yardsticks are similar.

From the rates previously shown in the development section of this chapter, the Bay States Abrasive Products Company (Plan No. 14) incentive calculation is shown:[33]

TABLE XV

HOW BONUS IS CALCULATED

Step 1. Number of jobs completed this week	230
Step 2. Actual hours worked by maintenance group	1250
Step 3. Computation of earned hours:	
Detailed way 230 X 0.98= 226 X 0.76= 175 X 0.95= 219 X 1.09= 251 X 0.75= 173 X 3.08= 708	
Total 1752 earned hours	
Summary Way 230X 7.61=1750.3	
Step 4. Computation of Performance $\frac{1752}{1250}$ = 140%	
Step 5. Computation of worker's share of improvement $\frac{40}{n\ 2}$ = 20%	
Step 6. Computation of Bonus: $\frac{20 / \text{sum of share of 7 previous weeks}}{8}$ = % for current week	

32. Anonymous interview.

33. Talman, p. 171.

Persons familiar with incentives may readily see that the methods of developing performance of incentives for indirect labor is not really much different than the type of incentives for indirect labor. A major concern in writing incentives for indirect labor in the factory is the cost of developing and administering the plan. Although development has cost a considerable amount of money in many of the plans discussed thus far, administration costs, namely, determining performance have been very low. In fact, when one considers the large sizes of some of the crews covered; fifty to three-hundred people and even more in some installations, the costs of applying the incentive per individual covered are very small.

Periods of Calculation of Incentive Performance. It may be seen from the illustration for the Bay States Abrasives plan (Plan No. 14) that step six covers the use of moving averages, based on the previous seven weeks performance being averaged into the wighth week's performance. This plan developed by the simplest means possible encompasses as the basis of the yardstick the number of jobs performed. Since maintenance work may vary so readily from week to week, although it runs consistantly over the long haul, this type of moving average is used to maintain a mere level performance.[34] If performance were paid in incentive payments as it existed each week, those weeks in which the crew worked the hardest, performance may be the poorest since the job count would be the lowest if more than the normal number of long

34. Ibid.

tedious jobs are scheduled. However, the crew, knowing that there will be long-jobs as well as short-jobs can look to better times ahead. For the initial eight payments, "you pay the first one as calculated - and calculate the following ones on a running average of previous figures until you read an 8-week accumulation, thereafter, you drop the earliest of 8 weeks!"

The aforementioned steel company plan for a utility division (Plan No. 16) has similar plans developed for maintenance crews. Although such complexities are not present as those found in the subject incentive, the same sort of yardstick of production is used. In departmental maintenance crews, as differentiated from general plant maintenance crews, the maintenance hours required would diminish as the direct crew hours diminished. Any deviation from this practice was a result of a special appropriation to allocate the funds. Such activities are excluded from the incentive since they are totally unrelated to any regularly planned program. In this company policy, it is specifically stated that up to 6 pay periods, twelve weeks, moving averages could be used in the calculation of performance. However due to the large crew sizes and relatively stable level of production, this prerogative was not taken for any of the incentives discussed in this thesis from that company.[35]

No shop incentives which calculate earnings on a quarterly or annual basis for indirect labor are included in this thesis.

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35. Ibid.

Such incentives are known to exist in degrees in such organizations as the Lincoln Electric Company and Hormel.[36] These, however, are annual bonus type plans which are not included in the sense of incentive plans as used in this thesis. They are more-or-less a bonus on profits as a result of better efforts of all employees rather than bonuses on the specifics of every day operations, such as budgets, or beating historical or calculated standards.

All of the plans discussed in this chapter with the exception of the Bay State Plan (Plan No. 14), are calculated on a one or two week pay period basis, whichever is the normal pay period of the specific company.

Control of Earnings. Recognizing that many of the methods of determining standards involve the use of arbitrary judgements on the part of the developer of the incentives, some companies feel the need of building controls into the incentive plans.

Since the Work-Factor plans previously discussed are based as much as possible on objective scientific determinations, no restrictions have been placed on the earnings of the plans. However, in the Kellogg plan(Plan No. 7) where tested electronic equipment is asided when a defect is found, a subjective problem is avoided. Knowing that the time to find an electrical problem in a circuit can vary considerably, this company chose to have such work repaired on unmeasured or daywork hours. Actually, in-

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36. Lincoln also has had piecework plans for many years, but the extra earnings aren't nearly as great as its annual bonus.

centive continued to exist in that workers working on daywork[37] are anxious to return to measured work since the maximum earnings on unmeasured daywork are the base rate. Neither penalty nor reward is given for slowness or speed for such activities.

An additional factor is applied as a control on the steel company utility division plan (Plan No. 16). This control comes in the form of a standard which when applied yields the minimum actual hours that may be used in the performance calculation. This figure or the actual hours is used as the denominator in the performance calculation, whichever, is greater. The use of the minimum actual hours that may be used rather than the actual hours result in a performance in the area of one hundred twenty per cent depending on the performance of the direct determinant crew in relation to their expected capacity performances. This maximum performance is desireable for two reasons.

> 1. Since direct crews can not achieve their capacity performances without considerable effort, if possible at all, due to equipment capacities, wage inequities are prevented by not allowing the indirect crews wages to soar ahead of the more critical jobs of the comparable direct crew classifications.
>
> 2. Service may suffer with less than the maximum actual hours being used, although this may not show up for years to come in excessively deteriorated equipment.[38]

In the case of this indirect crew, management has the absol-

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37. Daywork is work performed which is paid on the basis of a rate per unit of time worked regardless of production.

38. Anonymous Procedure Manual.

ute discretion of maintaining the number of employees in the indirect crew. To prevent any inequity to the indirect crew, management must exercise diligent effort to maintain the indirect crew hours slightly above the minimum indirect crew hours allowed.

An illustration of the calculation of the minimum actual hours allowed standard development follows:

TABLE XVI

CALCULATION OF MINIMUM ACTUAL HOURS ALLOWED

Appropriate Standard Time Value (.095)	X	Direct Earned Hours at Capacity Performance 12606	=	Earned Indirect Standard Hours @ Capacity Performance 1198
• 120% Maximum intended performance	=	Actual Indirect Hours at Capacity Performance 998	÷	Actual Direct Hours @ Capacity 10505

= The Standard Time Value for Minimum Actual Hours Allowed .095

This figure divided by the standard time value for the same level of operation yielded a factor which when applied to other standard time values in the previous example, yielded the scaled down standard time values for maximum actual hours allowed at various levels. In the above illustration, the standard time value and the standard time value for minimum actual hours allowed are equal since one hundred twenty per cent is the capacity

performance for the direct plan as well as the indirect plan. A check formula used to verify the minimum actual allowed standards could have been used in development of the minimum actual allowed standards could have been used in development of the minimum actual allowed standards but was not, due to fractional deviations which might change incentive performance. The formula follows:

$$\frac{\text{Standard Time Value}}{\text{Minimum Actual Standard}} \times \text{Index of Performance of the Direct Crew at Capacity} = \text{Capacity 120\% Perform.}$$

This formula if used for development of standards for minimum actual allowed hours would appear as follows:

$$\frac{.095}{x} \times 120\% = 120\%$$

$$\frac{.095(120)}{x} = 120$$

$$\frac{11.4}{x} = 120$$

$$X = .095$$ Standard Time Value for Minimum Actual Hours Allowed

In use, the standard time value for minimum actual hours would be applied to the actual hours of the appropriated direct crew just as the standard time values are applied to the earned hours of the appropriate direct crew. After being totalled from all direct determinant units, these hours would be used in the

performance calculation if greater than the actual hours worked by the indirect crew.[39]

A degree of control can be said to exist in the Bay State Plan (Plan No. 14) with its fifty-fifty split of earnings over standard. If the employees run away with performance they will bring savings to the company right along with themselves, since when an extra dollar is made by the employees, an extra dollar is made by the company.[40]

An interesting control to raise earnings was discovered in one of the aforementioned plans. Since direct workers can produce as much as they wish when unhampered by machine cycle times or raw material shortages, or slow feeds, there is no restriction on the amount of incentive that they may earn, within their own human endurance. Such is not generally the advantage of indirect workers. The savings on incentive depends on how few hours are used to do the work that is available. Thus a reduction of crew becomes mandatory to the success of many of these indirect incentive applications. The company which established the previously discussed material handler and set-up incentive (Plan No. 8) sought to make it an immediate success without any drastic reductions in crew size, further it was wisely believed that workers cannot suddenly improve their work effort to any appreciable extent. Such improvement only comes as a result of gradual conditioning.

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39. Anonymous interview.

40. Talman, p. 974.

Thus, a handicap was given to the crew to encourage them in bringing their performance up gradually. After studying company turnover records and discussing previous standard performance attainment times, a handicap was set up based on allowing that half of the distance in performance points between 87 and 114% to be added on the crew's actual performance and used as the actual basis of payment of incentive. This well served its purpose of allowing normal attrition to take its toll and a normally progressive training period to accustom remaining workers to the new pace. Charted, this handicap appears in Table XVII.

It can be seen that when the crew attains eighty-seven per cent performance on their own, they begin earning incentive with the handicap. Of course, when the one hundred fourteen per cent handicap limit is attained, there is no further handicap, and the crew stands on its own.

This handicap was permitted for a six-month period after installation of the plan.[41] Other controls of earnings which could appropriately be applied to incentive or indirect labor as well as direct labor are the pay plans found in various books showing the history of incentives. Gantt, Taylor, Bedaux, Rowan, Emerson and Halsey all have prescribed formulae to be used in the calculation of incentives. These incentive formulae generally follow a pattern to protect the company from loose rates, or provide a little extra stimulus to get the worker on to a higher production

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41. Anonymous Incentive Application Standards Manual.

TABLE XVII

INCENTIVE HANDICAP

Actual Performance	Performance With Handicap
86% and under	100% (Base Rate)
87	101
88	101
89	102
90	102
91	103
92	103
93	104
94	104
95	105
96	105
97	106
98	106
99	107
100	107
101	108
102	108
103	109
104	109
105	110
106	110
107	111
108	111
109	112
110	112
111	113
112	113
113	114
114	114

pace. These formulae will not be discussed further since their use and detail may be found in any number of places.[42] By and large, the plans in existence in the area of this thesis, other than those the writer has described as personalized (to the individual applications) splits of earnings, are paid on a one per cent incentive for each one per cent of performance over the standard rate. Performance of one hundred per cent or under is paid the base rate.

Distribution of Incentive Earnings. In all of these plans, members of the crew type incentives have participated in earnings at the same percentage added to their earnings, maintaining the higher ratio of pay for higher rated jobs. Individuals on non-crew type incentives all receive earnings based on their incentive performance. Normally, incentive earnings are paid in the week following the week in which the work is performed, however, there may be a greater lapse of time if inadequate time is available in this period to compile the data required to calculate the earnings.

An interesting feature in the foregoing utility plan (Plan No. 16) in the distribution of its earnings, is a feedback of earned hours that come in to the performance calculation from another plan. This plan, covering general plant service contains the bulk of the maintenance crew hours. Another portion of the maintenance hours are used in a utility plan which provides service to those utilities which are on direct type measurements. This smaller

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42. Michael J. Jucius, Personnel Management, (Homewood, Ill., 1955), p. 376.

group's earnings are based on ratios to their direct producing groups in the utility division. Specifying certain members of the unified maintenance crew to certain areas would impractical, and management had the performance of this crew calculated separately. Other members of this departmental crew earned at the performance of the departmental plan, while the maintenance hours, both earned and actual were carried into the general service plan to be included in its performance calculation. Thus, these maintenance people's performance was paid on the basis of the overall average, rather than their plans average.

This payment was considered just, because the individual workers efforts are performed as a part of either crew, even during the same pay period.

Much has been said about the benefits of crew incentives over individual incentives, or vice versa. Harold R. Nissley, a consulting Engineer recently presented arguments on the subject of individual incentives versus group incentives. Selected advantages of group incentives which are generally more suitable for measuring indirect are presented as follows:

> /Individual/measurement is time-consuming and frequently costly unless a management wishes to take some big chances with historical or "hunch" work standards. Moreover a spirit of cooperation is lacking in many individual incentive plans.
>
> Because much time is frequently spent in resolving operator time-study grievances, such operator grievances are usually reduced when a group incentive plan is substituted for an individual incentive plan.

> Moreover, under a group incentive plan there develops (theoretically, at least) a group esprit de corps that gets out production with a minimum amount of fuss and friction, everyone pitches in regardless of whose job it is.[43]

The article goes on to tell how absences of a member of a group are less of a problem when other workers can fill the gap to maintain their earnings. The extra costs of installing individual incentives are presented in favor of group incentives.

The disadvantages of the group plan is that individual effort may be too diluted to yield the best efforts, standards may be too loosely developed and the group incentives require more experience by the company, union, and the industry if they are to be successful.

The arguments presented weigh heavier in favor of group incentives bearing in mind that the measurement of the workers should be as closely controlled by the worker included, as is possible. A total plant incentive leaves the workers with the feeling that what they may do as individuals isn't going to hurt or help the plan noticeably. Thus, if all workers felt this way the plan would yield poor performances, and the advantages of having an incentive would diminish.

CHAPTER IV

INCENTIVES FOR MANAGEMENT

Levels Included. "Hey, boss'. You want me to cash your check?"[1] This remark was passed after an employee had observed his foreman waiting in line to cash his pay check, and arose from the worker's overtime and incentive making his take-home pay higher than that of his foreman.

Nothing can be so demoralizing to the top levels in a plant as having subordinates making more than their supervisors. Many companies avoid this situation by giving supervisors and other management raises as they are given to the hourly workers.

Other companies feel that such practices make it appear as if the union's bargaining is pushing management wages upward. Many of these companies have chosen management incentives as a way to give extra rewards to management for jobs well done.

The New Britain Machine Company (Plan No. 17) of New Britain, Connecticut, has a supervisory incentive covering "Supervisors and Assistant Supervisors of the Major Manufacturing and Assembly Departments."[2] This plan was installed to make supervisors a part

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1. Roger M. Bellows, Psychology of Personnel in Business and Industry, (New York, 1949), p. 219.

2. McCarthy, p. 104.

of the "management team," raise supervisors earnings, reduce supervisor turnover, can make supervisors more aware of costs.

The previously mentioned American Seating Plan (Plan No. 3) covers all of its "Middle management," defined as everyone on the exempt payroll (salaried personnel who are not eligible for compulsory overtime under Federal Regulations). Company officers and senior executives, people charged with the administration of the plan, and salesman who work on commission are not included.[3]

Another company which has requested that it remain anonymous has a management incentive covering hundreds of management employees to include accounting people, industrial engineering people and all foremen, supervisors, and engineers who are considered management. The top levels of every department supervisors and non- supervisors who are categorized as "Management," participate in the incentive.[4]

Stock options are a method in which incentives given top executives to encourage better efforts in their work, since as they themselves become owners of the business, they stand to profit as the company profits.[5]

The United States Steel Corporation (Plan No. 18) has an employee stock plan for all salaried employees who are not eligible

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3. Heidgen, p. 98.

4. Anonymous Interview.

5. Michael J. Jucius, Personnel Management (Homewood, Ill., 1955), p. 387.

TABLE XVIII

INCENTIVE PLANS DISCUSSED IN THIS CHAPTER

Plan No.	Occupation (Company)	Page References
17.	Supervisory (New Britain Machine)	74, 77, 79, 84, 85, 87, 88.
18.	Salaried Employees (U. S. Steel)	75.
19.	Management (Anonymous)	75, 81, 88.
20.	Foremen (Gantt)	82, 84.

for union membership. This plan covers office workers, middle management, supervisors and other wide ranges of non-union job classifications. While not an incentive plan yielding specific rewards for specific meritorious deeds, it is an incentive much in the same manner that the top executives stock options are an incentive. Although, a plan covering tens of thousands of employees as this plan does, cannot be expected to have a very strong impact on the individual. Its major merit lies in its provisions which encourage long job tenure. This will be discussed later in this chapter in the section covering the distribution of incentive earnings.[6]

Yardsticks of Production. In order to provide an orderly incentive measurement that would give a reasonable measure of performance and still maintain the prestige of the individual, incentives vastly different from these used for indirect jobs in the factory had to be developed for positions of management.

The New Britain Machine Company plan (Plan No. 17) selected a multitude of factors to serve as the yardstick for their supervisory team. The seven factors considered are presented below:

1. Departmental Activity Factor is expressed in terms of production hours. The standard base, at which bonus starts, is approximately 50% of normal volume. Normal volume of productive hours is 80% of one shift capacity. Supervisors are not penalized for volumes under the standard base..

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6. U..S. Steel Corporation --Employee Savings Plan. A pamphlet explaining the employee savings plan, approved by the Board of Directors and Stockholders for installation May 1, 1957.

2. Non-productive Labor Factor covers assistand foremen, department clerks, sweepers, material handlers, and others employed within the department or temporarily borrowed from other sections. The standard number of hours at any volume of activity is the sum of a fixed minimum plus an amount that varies directly with the volume . . . .

3. Scrap Factor is based on the manufacturing cost of departmental scrap to and including the operation at which an item is scrapped.

4. Reclaim Factor is based on the cost of reclaiming or reworking salvageable damaged products for which the department is responsible.

5. Supplies and Small Tool Factor is based on the value of such items acquired by a direct purchase or internal requisition . . . .

6. Service Factor is based on the hours charged to a department from internal or external sources for: lost time (sick, injured, or absent); maintenance and repair of machinery, equipment facilities, tools, dies, and fixtures . . .

7. Performance Factor is based on the ratio of production employees' actual hours to standard hours . . .[7]

Another company, which has chosen to remain anonymous, has a management incentive plan based on performance against rigidly defined standard costs and budget. As a second effect, the plan includes additional rewards for management tightening its budget standards. This tightening serves to reduce budgets, making the continued attainment of incentive on budget performance more difficult and this pays handsome rewards for such tightenings.

An incentive based on the performance of the supervisor's people is suggested by Robert Rice, the Industrial Production Editor of Factory Magazine.[8] This yardstick may have a tendency to bring the

7. McCarthy p. 105.
8. Rice, p. 96.

supervisor closer to the level of his workers, a thought which is not relished by some managements. Other yardsticks may be "an index of employee unrest in a department, miscellaneous records of a quantitative sort are sometimes applicable . . . . and subjective judgements including attitude scales and rating devices may be used by higher management."[9] The yardstick of general company prosperity is the measure used in the stock option plans or the U. S. Steel Employee Savings Plan.

Methods of measurement or Developing Standards. Obviously the management jobs are so diversified that you would not be able to study them with a stopwatch. Work sampling or other time study methods would take away the dignity of management. Besides, management at its very best, when the job is well under control, may be sitting with their feet propped up on a desk. Thus, the measurement of management's performance must be established through accomplishments in the past rather than direct observation. Some of the accomplishments that serve as the basis of measurement standards will be discussed in this section.

The previously mentioned American Seating Company (Plan No.3) and the New Britain Machine Company Plans (Plan No 17) both base their supervisory incentives on "past records and current conditions."[10] In developing standards, New Britain had to study the data and apply logic to determine the best way to measure each

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9. Bellows, p. 220.

10. McCarthy, p. 102.

factor. Factor weighting--how much of the total potential bonus should be apportioned to each factor--was determined the same way, by study of the facts."[11] Cost savings played a big part in the development of standards. Ratios were established to determine which factors were important and to what degree. The various factors where foremen had control were analyzed on the basis of what has been normal performance.. The degree of possible improvement was calculated and a chart established to show the amount of cost reduction that would bring a given amount of dollars to the foreman. The following formula will show how this dollar reward was established:

Assigned percentages X Normal cost = % Reward to Foremen

$$\frac{\$ \text{ Savings}}{\text{Ratio Established}} = \% \text{ Reward to Foremen}$$

% Reward to Foremen X Ratio of Pay = $ Reward to Fore.

Although this plan involves arbitrary judgements after the normal is established, its equitability can be determined by the fact that the dollar savings to the company is a by-product of the performance calculation. Such being the case, it is obvious to the supervisors how much of a share of the savings on a given cost item goes to them.. Management in turn dare not be unfair when such unfairness would be so very obvious.

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11. Ibid., p..105.

The standards for another plan (Plan No. 19)[12] covering all occupations of management were formulated arbitrarily and based on historical performance. Executive Management decided that ninety-seven per cent cost performance was "par for the course," and said that would be 100% incentive performance for budget performance. For each additional one percent of cost performance, management received five per cent more incentive up to a maximum of twenty five per cent incentive for cost performance up to 102%. Another facet of the plan allows incentive earnings for tightening those very standards that yield the incentive earnings. The proportion selected for this facet is 10% of a years pay to management for each one per cent of tightening of the plant's budget. The questions one may ask here are, "What does one per cent of budget performance mean in terms of dollars saved and how much would five per cent of the total management payroll amount to?" If these figures are two to one, respectively, the management group would be sharing savings fifty-fifty with the company.

The company keeps all savings earned when budget performance is over the 102% mark. This is where the tightening comes in. IF 102% performance can be maintained, area managers should tighten their budget standards and cash in on the "big kill", budget improvement award. Of course, if standards are tightened too much, management loses on its budget performance incentive. The questions

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12. The source of this plan has requested that it remain anonymous. Also, it has chosen not to indicate those particulars that would indicate how equitable the plan is.

asked to determine equitability in this factor are, "How much is one per cent of the plant budget as compared to ten per cent of the annual management payroll"? This latter factor has a speed-up effect in that once the standards have tightened, they will be tight from then on, although the reward, however handsome, is only given once.

Although this plan will tend to level out at a constant performance, it will perpetually keep management on its toes and the objectives of controlling costs will continue to be achieved.

Other management incentive plans which measured the foremen alone, are some of the older plans (Plan No. 20):

> Perhaps the oldest form of compensating supervisors and foremen upon a basis other than straight salary is that of paying them a bonus, depending upon the incentive earnings of their subordinates. For example, under the Gantt Plan (one of the early plans), provision was originally made for paying supervisors a bonus which increased as the number of subordinates who earned a bonus increased. And under some adoptions of the Halsey Plan, the supervisor shared in part of the time saved by his subordinates. Thus the employee received 66-2/3 per cent of the time saved, and the supervisor, an indirect worker in the department, received the remaining 33-1/3 per cent. In some installations of the Bedaux Plan, the supervisor receives 25 per cent of the B's saved 13

The "objective and quantitative" measure of performance of a foreman's workers may easily be established from pay records or counts of pieces. Rejects, scrap or wasted material may be (a) compared to the index for last month or last year to see whether the department was up to its previous record or (b) compared to a set standard established by an efficiency specialist ....."14

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12. Jucius, p. 389.
13. Bellows, p. 221.

Basically, it may be said that the method of determining the standards for the management is a subjective and arbitrary measure. Were management to affect the "shape or form of the product," measures as objective as those for direct labor employees, could be used.

Methods of Determining Performance. Performance is calculated as in all previously mentioned plans, by the dividing of the standard unit of measure by the actual unit of measure or just assigning a given number of dollars, or a performance from someone else's (the direct crews) earnings.

In the previously mentioned anonymous plan (Plan No. 19) for all members of management, the budgets are based on standard cost and they reflect various levels of operating conditions. For instance, if production is cut in half, a plant manager is still allowed, industrial engineering may have to reduce forces 10%, some general foremen may be "bumped" down, other pre-established quantities of foremen may be eliminated, direct labor will, of course, be cut approximately in half, utilities will diminish by one-third, raw material requirements will be cut in half, etc. If all of these conditions are met to the letter, management has met its budget to the letter and the calculation of standard (budget) performance over actual performance equals 100%. Under the rules this one hundred per cent would yield fifteen per cent incentive. On the other factor of this plan, savings on budget tightenings are divided by the appropriate plant budget figure to reveal the per cent of effect. This figure when multiplied by ten would reveal

the per cent of effect. This figure when multiplied by ten would reveal the performance to be paid on this factor.[15]

The New Britain Machine Company plan (Plan No. 17) is applied as follows:

> The rates of rewards and penalties for each factor were summarized, by departments, on "Normals and Formulas" forms--one for each department . . . .
>
> At the end of each 4-week period the Accounting Department prepares a "Supervisors Incentive Report," . . . . It is calculated by applying the rates on the normals and formulas sheets to current actual performance and cost data for each department.
>
> Control effectiveness is found by dividing the actual quantities by normal--100% is normal performance; under 100% is better than normal, and more than 100% is sub-standard.
>
> Pluses and minuses are added. The difference is the net percentage bonus--percentage of base salary.[16]

Tables XIX and XX show how the performance is actually calculated.

An incentive based on "a combined index of the efficiency of who are under the foreman"[17] would give the foreman the same overall performance as his workers. Of course, the Gantt version (Plan No. 20) previously mentioned increases earnings as the number of workers under the foreman increases. The Gantt arrangement has merit in that a supervisor will exercise more supervision when he supervises more people. Consideration must, of course, be given to the nature of the work. A company turning out the exact

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15. Anonymous interview.

16. McCarthy, p. 105.

17. Bellows, p. 220.

TABLE XIX

NORMALS AND FORMULAS FORM

Rewards and Penalties

% of Norm	Reward	% of Norm	Reward	%of Norm	Reward
55%	0%	87%	7%	123%	14%
60%	1	91%	8	130%	15
64%	2	96%	9	139%	16
69%	3	100%	10	149%	17
73%	4	105%	11	161%	18
78%	5	110%	12	177%	19
82%	6	116%	13	218%	20

Factor	Normal	Rewards and Penalties
Non-Prod Hours	.075 times the direct hours for the period plus 100 hours.	Divide the actual non-productive hours by the normal non-productive hours and for each 4% below or above 100% add or deduct 1% of salary.
Non-Prod Hours	.0049 times the direct hours for the period.	Divide the actual scrap cost for the period by the normal scrap cost, and for each 50% below or above 100% add or deduct 1% of bonus.
Reclaim	.0027 times the average direct hours for the period.	Divide the actual reclaim cost for the period by the normal, and for each 70% below or above 100% add or deduct 1% of bonus.
Supplies	.065 times the average direct hours for the last 3 periods, plus $30.	Divide the average cost of supplies for the last three periods by the normal, and for each 6% below or above 100% add or deduct 1% of bonus.
Service Hours	.015 times the direct hours for the period plus 26 hours.	Divide the actual service hours for the period by the normal, and for each 12% below or above 100% add or deduct 1% of bonus.

TABLE XIX (Continued)

NORMALS AND FORMULAS FORM

Factor	Normal			Rewards and Penalties			
Performance Ratio	100%			The per cent or reward or penalty is determined by direct reading on the following table:			
Performance Ratio	Reward	Performance Ratio	Reward	Performance Ratio	Penalty	Performance Ratio	Penalty
90%	1%	65%	5%	110%	1%	135%	5%
80	2	60	6	120	2	140	6
75	3	55	7	125	3	150	7
70	4			130	4		

same product, year after year, having high individual worker specialization requires less supervision per foreman, than a company having a job shop operation where worker's chores change almost daily.

Periods of Calculation of Incentive Earnings. By and large the more desireable, several-factor management incentives are calculated over a longer period of time than are plans for other groups discussed. It is obvious that management must look at the good and the bad, the "big picture." Nearly every industry has fluctuations during the year due to seasonal buying and selling trends. Although these changes seldom effect the lower echelon workers, except through unemployment which then ceases to be a manufacturing problem, they do cause fluctuation in the profits from period to period. Management should be rewarded for its

TABLE XX

SUPERVISOR'S INCENTIVE REPORT

Supervisor John Doe Reriod June

Activity	Normal	Actual	%	+	-
1. Productive hrs.	12,000	15,960.0	133.0%	15.30%	
2. Non-productive hrs.	1,190	1,215.0	102.1		.60%
3. Scrap	$78	$63	80.8	.38%	
4. Reclaims	$43	$21	48.8	.73%	
5. Supplies (3 Month Average)	$918	$1,091.06	119.0		3.17%
6. Service (3 Month Average)	237	121.3	51.3	4.06%	
7. Performance Ratio	100%	75.5	75.5%	2.90%	
		Total		23.37%	3.77%
		Net Percentage		19.60%	
		Dollars		$98..	

efforts to adjust expenses when such adjustments are called for. To only economize in good times could be a disastrous mistake.

The previously mentioned New Britain plan (Plan No. 17) calculates performance on a monthly basis. With the type of items considered and the weighting of the items, this is an acceptable

period of time. But for the aforementioned anonymous incentive plan for management, the wide range of total budget considerations, including less controllable items warrant a longer calculation period. In this plan the calculation is made over a three month basis. However, a six-month moving average is used in the performance calculation. Thus a bad month, or a good one will carry its impact for two incentive periods. The aforementioned American Seating Plan (Plan No. 3) used for management, as well as for clerical workers, pays quarterly, although a cumulative yearly average is developed for the final payment. The quarterly payments are only prepayments for the expected attainable earnings.

Control of Earnings. In the anonymous management incentive plan (Plan No. 19), just mentioned, performance for higher than 102% does not receive any additional incentive pay. This control prevents looseness from being perpetuated, and management would request a budget tightening to achieve closer to standard 100% budget performance. But if management requests too much of a tightening in order to obtain the big reward of 10% of a years pay for each 1% tightening, they will suffer in future achievement of the budget performance earnings. This plan has virtually unlimited ceilings in that improvements may always be made. The New Britain plan (Plan No. 17) also has no limit to earnings, while the American Seating plan (Plan No. 3) has limits of an equitable fifteen, twenty-five or thirty-five per cent based on "the effect a man in a given job may have on costs."

Generally, top management would consider its management groups

honorable enough to achieve its earnings honestly for whatever the motive for doing a job, desire to get ahead or for the extra money, the reward is nonetheless earned.

Distribution of Incentive Earnings. The New Britain plan (Plan No. 17) for supervisors is the closeat to paying the individual supervisor for his special efforts. If he's the one who has done a spectacular job, he's the one who should get the reward. The anonymous plan discussed pays the entire management force its bonus at the same percentage. Being based on budgets and not personalized performance factors, it recognizes that some budgets were tight and some loose when the plan was installed. It is interesting to note that no one seems to condemn those individuals whose departments have poor performance. Likewise, no one praises those individuals whose performance is high. Management knows that the budgets were not all perfect when the plan was set up. In fact, if someone does do something outstanding to raise the total incentive performance, he is almost looked on as being a little foolish by his associates. This represents a grave difference of philosophies between management and factory workers in the discussion of individual or group incentives mentioned in Chapter III. Part of management's attitude in judging its associates in this company may stem from an otherwise insignificant expression in the incentive procedure manual, that "at the outset" the incentive would pay the same performance to all members of management. Perhaps, top management will put the incentive on a departmental or individual basis when budget variations level out in time.

CHAPTER V

THE EFFECTS OF AUTOMATION ON INDIRECT LABOR

The effects of automation are a much discussed subject in recent years. Its effect on the indirect work force is just the opposite for office workers as it is for the indirect factory workers. In the factory it is normally the direct workers, those who affect the quality or form of the product, who are effected. The processes of bringing material in, maintenance, unloading machines, packing and shipping may not only continue to exist, but may increase manyfold due to the greater quantities of products that are being made. In a fully automatic plant, maintenance may be the largest crew of them all.

Even with fully electronic automation, where men moving parts from station to station are eliminated,[1] "the only loading and unloading required is at the beginning and end of the production line embodied in the transfer machine".[2] The men who load at the beginning and unload at the end do not make the product and are, therefor, indirect labor. Since "this stage of automation involves a higher degree of electronic control, and still fewer men", the

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1. Carl Dreher, Automation: What It Is, How It Works, Who Can Use It, (New York, 1957), p. 19.

2. Automatic materials-handling machines are sometimes called "transfer machines".

3. Dreher, p. 19.

ratio of indirect to direct has increased considerably. In fact in this fully automatic type of automation, such as exists in Detroit in automobile engine plants, there may be no direct labor. The man who operates the controls to make the product is making the product indirectly. This is of course, a fine point allowing personal interpretations to ascertain if such automatic equipment operators are direct or indirect labor.

In the office, automation has the effect of lessening the amount of indirect labor that is required. Tedious production control inventory record keeping, can be performed on machines in a fraction of the time that is used by human beings. Billing, payroll keeping, performance calculating and machine loading can all be done automatically, resulting in wide-spread reductions in indirect labor. Electronic marvels now under development will even take dictation and reproduce it in letter form at a considerably faster rate. "It seems now almost certain that the secretary will not be seen in the office management of tomorrow."[4]

Reductions of clerical workers are evidenced by such statistics as, "in an insurance company studied by the Department of Labor, a large scale computer replaced 133 persons ... ."[5] "An IBM-702 installed by the Bank of America performs work equivalent

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4. Rolf Strehl, The Robots are Among Us, (New York, 1955), p. 181.

5. Georgiana M. Smith. Office Automation and White Collar Employment, (Rutgers, 1959) p. 12, citing Van Auken, in U. S. Government Pamphlet, p. 11.

to 130 clerks . . .";[6] thirty-eight of these workers were retrained to operate the machine. "Erma, the same banks special purpose computer, replaces 86 clerks".[7]

How about the nature of work that is performed? "Automation promises the elimination of routine, repetitive jobs (in the factory). It makes possible the creation of greatly improved working conditions and the reduction in the length of the work weeks".[8]

Now do all of these facts effect incentives for indirect labor? In the clerical area we see possibly more repetitive efforts than existed previously. Incentive-wise, this is most advantageous. Incentives can be established on the unit of production that is constantly being repeated as was the situation in a few of the Pitney Bowes jobs mentioned earlier. The secretary who has the least repetitive job of all, and thereby the most difficult to measure, may cease to exist and thereby reduce the number of unmeasured occupations. Any of the piece-work type of incentives may be applied in such an automation office situation.

In the factory where material handling is concerned, performance may be judged on the basis of equipment performances, where if a machine has a capacity of a given figure, performance may be given in relationship to attainment of that figure. Thus the

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6. Ibid., citing statement of A. Zipf, Bank of America, "Automation and Recent Trends", p. 82.

7. Ibid., citing H. B. Douglas speech to Institute on Electronics in Management, May, 1956.

8. "Labor Looks at Automation", AFL-CIO Publication No.21 (May 1956), p. 21.

relationship of output governed by input still has the human factor involved.

> Materials handling, however, is probably the limiting factor in most cases. Despite considerable technological development, there still is the problem of economically moving materials around the plant, without human intervention or assistance.[9]

Maintenance is one of the major areas of indirect labor in the automated factory. Contrary to the belief of some, incentives can easily be applied to maintenance crews in the automated factory. In any incentive installation, the factor of whether the end result justifies the expense must be considered.

Where automation has been employed, it has been done because of a tremendous output of a repetitive item, thus the equipment and maintenance crew will continue to endure in sufficient quantities to justify the expenditures involved in establishing a maintenance incentive.

Several of the previously mentioned plans may be applied to cover automated equipment maintenance.

In the development of automated equipment, wear points are recognized. Spare parts for these areas are always maintained for either periodic replacement or emergency repairs as needed. One large steel company maintains incentive standards on a task list basis similar to that used in the previously mentioned U. S. Navy plan. Such items as changing the various rolls in rolling

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9. "Automation--Threat or Promise," ACME Reporter, (May 1956) p. 1.

mills, relining hot metal equipment, changing roll table rollers, and furnace grate bars are measured on a per job basis. Methods for standards describe the number of men required, and the steps of the maintenance process which must be gone through to effect an orderly conversion of old parts to new. Bench work jobs, as used in the Navy incentive would apply to a fully automatic plant complete with transfer equipment. Certain types of maintenance, though not included in the standards, are similar to other jobs for which there are standards.

The Bay States Abrasive Products Company plan, which strikes averages of maintenance work times, may be adopted, by determining what sort of maintenance jobs are done and observing the time required for such jobs. This type of incentive plan would continue to be effective after equipment ages and requires more repairs. Although management may be unable to maintain a standard cost figure in the beginning for the maintenance crew, it would know that so long as the maintenance crew is at 100% performance or better excessive maintenance hours are not being used. Doubtlessly, a trend of requirements for increasing maintenance hours could be recognized. This would allow for budgeting on the forecasted level of maintenance hours. Indeed, management could determine from this record the point at which existing equipment should be replaced as requiring too many repairs for economical operation.10

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10. Delay records would complete this picture to reveal minimum economical operating acceptability of equipment.

Thus it is seen that automation serves to cause stability or use of more desireable incentive yardsticks than existed for the occupations in the non-automated occupations. Generally, the occupations in which more repetitive work is performed, a lower job classification is found and there would be less resistance to the loss of dignity when work is performed under an incentive system.

CHAPTER VI

SUMMARY AND CONCLUSIONS

It has been evidenced that many labor groups which are not normally considered as measurable for incentives are in reality very measurable. The illustrations portrayed in this study show how some companies handled the installation, development and administration of their incentives for indirect labor. Although each incentive must be tailored to suit the individual situation, similarities of situations may be recognized to provide a key to tailoring other incentive applications.

Basically, the normal incentive rules may be followed where the jobs to be measured, whether clerical or hourly,, are repetitive. Any method of study and establishing rates may be used. However, when studying clerical groups, great care must be exercised to recognize the dignity or social status of the group. Because of tradition, the Industrial Engineer cannot just walk in and clock such groups. He must be introduced into the group and give a full explanation of what he intends to do.

In the chapter on clerical incentives, the author has discussed incentives to cover nearly every type of office group. In the more repetitive types of occupations, direct types of measurements were shown. Counts of production were entered by the individual worker to later be calculated by the accounting group. Another company measured its clerical group in a budget performance

type of plan allowing various maximum performances based on the extent to which the individuals contributed to controlling costs. While appearing similar to profit sharing at a quick glance, a closer look reveals that a plant may continue to operate well within its budgets when sales, and thereby profits, are sharply reduced.

The chapter on hourly jobs in the factory covered a wide variety of jobs. Incentives were mentioned either in detail or briefly for every indirect function surrounding the direct production of a company.. Janitors, material handler, set-up men, packing and shipping workers, and maintenance, to name a few, were discussed in Chapter III. Both direct and indirect types of measurement were used. Methods of establishing standards ranged from the use of detailed predetermined standard time values through stop watch, estimates, relationships to direct hours, and historical data. Incentives were shown that did not differ significantly from piece work type incentives, in that they paid incentive on work related to the number of units handled. The large scale utility incentive with its scaled up standards to cover lowere levels of plant activity looks very much like a gift. Perhaps its yield in some areas of more work from the worker is not as great as one would like. But a fixed station operator could still, by closer scrutiny of his equipment, and additional preventive maintenance, and even performance of a few simple maintenance chores, contribute to better efficiency and plant operation. Further,. by the use of incentives in this area, since most other

areas are covered, the company is able to avoid distorting its job evaluation program. If jobs were to be given a raise in pay for not being able to earn incentives, in time they may be twisted around to sound as though other workers are paid less when they can earn incentive. Thus, there is no incentive at all, a worker would feel that he has to work at an incentive pace just to get what is coming to him.

Incentives should attempt to reward the better performance as soon as possible after the work is performed. This would mean rewards should come at the same time as the pay check for the period worked. However, where performances vary widely due to conditions of fluctuations or the nature of the work that is done, incentive payments may be levelled over an extended period of time. The period should be just long enough to eliminate the severe peaks and valleys. The further the reward is from the effort, the less effect it has on causing better future performance. Although, in the Bay States Abrasive Products maintenance plan, being based on a per job measurement, it is possible that a very long job may be worked on with the greatest effort, yet the job count would be small and earnings would be low. This plan levels performance out for several weeks by moving averages to eliminate that possibility.

Earnings should be distributed equally to all members of the same crew in hourly indirect crew incentives. Certain workers, such as group leaders may do more organizing of work than actual work itself, but they contribute nonetheless to performance. In

fact, if they have planned carefully, their contribution may be of most significant importance.

Management must not be forgotten in the incentive picture. Just the payment of high wages does not give a company its best dollars worth in management labor. The management incentive is very important. It ensures more careful training, both by higher supervisors and by the individuals themselves to enable better performance to be made on the management incentive; the management incentives provide the yardstick which will measure how good the management team is.

Other techniques which are not readily categorized as incentives, are stock option plans. These are more or less attempts to appeal to the self survival instinct. By making the employees a stockholder, it is hoped that he will work harder to make his stock more valuable. Also, the method by which stock may be given, may encourage less employee turnover.

The United States Steel Corporation has a stock option plan for all non-union employees. This plan pays fifty cents for each employee dollar to be vested after the third year. Employees may save from one to eight per cent of their salary depending on their length of service and/or their status. This plan, having the three year vestment clause assures longer tenure of employment. If a worker leaves before his third year, he does not receive any of the company's share. The employee's dollar may be invested, all or fifty per cent in U. S. Government bonds or bond issues, and up to fifty per cent in company stock. The company's share will be in

company stock. All stock is bought at the current market price.

Other companies give employees options to buy a certain amount of stock at a greatly reduced rate. Top executives are often given stock options to make the position more inviting as well as making him an important shareholder to insure greater interest in the company.

Automation has been seen to provide a greater degree of repetitiveness in many office operations and cause an increase in the ratio of indirect to direct labor in the factory. The latter is caused by the fact that it is the production phases that are displaced by automation in the factory. Also, more equipment means more maintenance is required.

Incentives for indirect labor will gain increasing prominance in industry and businesses in years to come. Management is always seeking to find new ways to meet the ever increasing threat of competition and new products. Modern day work simplification says that there is always a better way to do a job. Management is looking for this way. With the extensive coverage of direct labor, management in now turning its Industrial Engineer's efforts toward measuring the indirects.

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APPROVAL SHEET

The thesis submitted by Gerald Curtis Stone has been read and approved by three members of the faculty of the Institute of Social and Industrial Relations.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Social and Industrial Relations.

June 1, 1960
Date

Signature of Advisor